EVALUATION OF GUAVA (*Psidium guajava* L.) VARIETIES FOR PROCESSING INTO NECTAR AND READY-TO-SERVE BEVERAGES

M.Sc.(Ag.) THESIS

by

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CERTIFICATE – I

This is to certify that the thesis entitled **"EVALUATION OF GUAVA (***Psidium guajava* L.**) VARIETIES FOR PROCESSING INTO NECTAR AND READY-TO-SERVE BEVERAGES"** submitted in partial fulfilment of the requirements for the degree of **"Master of Science in Agriculture"** of the Indira Gandhi Agricultural University, Raipur, is a record of the bonafide research work carried out by **Shri MADAN LAL CHOUDHARY** under my guidance and supervision. The subject of the thesis has been approved by Student's Advisory Committee and the Director of Instructions.

No part of the thesis has been submitted for any other degree or diploma (certificate awarded etc.) or has been published/ published part has been fully acknowledged. All the assistance and help received during the course of the investigations have been duly acknowledged by him.

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This is to certify that the thesis entitled **"EVALUATION OF GUAVA (*Psidium guajava* L.) VARIETIES FOR PROCESSING INTO NECTAR AND READY-TO-SERVE BEVERAGES"** submitted by **MADAN LAL CHOUDHARY** to the Indira Gandhi Agricultural University, Raipur in partial fulfilment of the requirements for the degree of **M.Sc. (Ag.)** in the **Department of Horticulture** has been approved by the Student's Advisory Committee after oral examination in collaboration with the external examiner.

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LIST OF ABBREVIATIONS

Abbreviations	Description
%	Per cent
&	And
^{0}B	Degree Brix
^{0}C	Degree Celsius
AC	Apple Colour
AS	Allahabad Safeda
L-49	Lucknow-49
R-72	Rewa-72
CD	Critical difference
cm	Centimetre
cv.	Cultivar
d.f.	Degree of freedom
et al.	and others/ co-workers
F. P. O.	Food Product Order
Fig.	Figure
g	Gram
i.e.	That is
kg	Kilogram
KMS	Potassium meta bisulphite
m	Metre
mg	Milligram
ml	Millilitre
no.	Number
NS	Non-significant
ppm	Parts per million
RTS	Ready-to-serve
SEm±	Standard error of mean
TSS	Total Soluble Solids
viz.	Namely
vol.	Volume
wt.	Weight

CHAPTER-I

INTRODUCTION

Guava (*Psidium guajava* L.), a very popular fruit is an indigenous to tropical America and belongs to family 'Myrtaceae'. It has been under cultivation in India since early 17th century. It is fifth important fruit crop covering an area of 1.51 lakh ha with a total production of 18.00 lakh tonnes and productivity 11.90 tonnes/ha in India during 1998-99 (Chadha, 2002). In Chhattisgarh, guava is being grown on a limited area of about 671.40 ha with a production of 11810 metric tonnes and productivity 17.60 tonnes/ha (Anon, 2004). However, it can be grown successfully in almost all parts of the Chhattisgarh.

Guava is one of the most important commercial fruit crops of India. It excels most of the other fruit crops in productivity, hardiness, adaptability and vitamin C content of the fruits (Tandon *et al.*, 1983; Singh *et al.*, 1993). Being very hardy in nature, it gives an assured crop even with very little care. The cost of production of guava is also low because its requirement for fertilizer, irrigation and plant protection are not much. Moreover, the guava fruit is an excellent source of vitamin C ranging from 70 to 350 mg/100 g, which is about two to five times more than orange and ten times to that of tomato. Apart from vitamin C, it is also a rich source of minerals like calcium, phosphorus, iron etc. The fruit contains substantial quantity of vitamin A, pantothenic acid, riboflavin, thiamin and niacin. Although, the guava fruit is nutritious but it is highly perishable and cannot be transported to distant places for marketing. Besides using as fresh, its fruits are being processed into various products like jam,

jelly, cheese, ketchup, clarified juice, powder, toffee, flakes, nectars, butter paste for domestic market as well as export. It is a rich source of pectin ranging from 0.52 to 2.0 per cent. There is a drastic reduction in pectin content when its fruits are over ripened (Attri and Singh, 2003). The use of pectic enzymes in association with fining agent in fruit processing is essential to get better juice yields, improve filtration rate and produce clear juice of high quality for the concentration process (Pilnik and Vorange, 1989). Therefore, it is considered as an ideal fruit for the nutritional security.

Guava is being grown successfully in the tropical and subtropical climate. In the areas having distinct winter, the yield tends to increase as well as quality also improves. It is widely distributed with highest productivity in Gujarat although best quality fruits are produced in Uttar Pradesh. Uttar Pradesh is one of the most important states of India where about half of the total area is under guava and the district Allahabad has reputation of growing the best quality guava in the country as well as in the world (Mitra and Bose, 1985).

In India, soft drinks have a good demand practically throughout the year. Traditionally, our country has been well-known for offering syrup or sharbet. Amongst these, fruit juice and beverages have an important place as they are rich in essential minerals, vitamins and other nutritive constituents. They are also liked and appreciated by the people of all ages and acceptable on all occasions. Besides, they are delicious and have a universal appeal unlike other beverages. The nutritive value of fruit beverages are much more than the synthetic products which are available in the market throughout the country. If fruit juice could be substituted with the synthetic drinks, it would be beneficial

to the consumer as well as fruit growers. Looking to the demand of natural beverages, there is a great scope for the preparation of fruit juice and other fruit based beverages.

Guava fruit is highly perishable in nature and seasonal. It is easily available in plenty during certain quarters of the year at cheaper rate. The cold storage facilities are not within the reach of the growers and therefore, the crop has to be sold at unremunerative prices. However, cold storage is not the only alternative to the problem. Hence, there is an urgent necessity to develop some suitable technology for the preparation of guava beverages, which could be economical and made available to a large population. The palatable product of guava should have many of the dietary values of fresh fruits. Hence, the preservation of fruits partially solves this problem and also helps to control glut and very low prices in the market.

In India, now-a-days, the guava fruits are mostly consumed as fresh or utilized for the purpose of canning and jelly making. Due to increasing cost of cans and sugar, both the preserved products are losing their values in the market. On the other hand, the demand for some of the typical Indian fruit beverages of mango, guava, banana, citrus, *aonla*, pomegranate, pineapple and apple etc. is increasing and gaining importance in India and other countries. Among these, guava nectar and RTS have more potential for future expansion and may be the delicious products, which can be utilized throughout the year. According to Negy and Shaw (1980), the guava production in India is highest in the world but its processed products are very limited. This is probably due to lack of systematic study in regard to the processing technology of guava nectar and

RTS as well as evaluation of various cultivars with respect to their preparation. Due to perishable nature, the fruits cannot be stored for more than a week at ambient condition and ultimately it cannot be sent to distant markets. This causes glut and spoilage of fruits during the peak harvest period resulting in wastage and poor returns to the growers. Therefore, it becomes essential to utilize the fruits for making different quality products which can be stored for longer period.

Considering the above facts, an investigation entitled "Evaluation of guava (*Psidium guajava* L.) varieties for processing into nectar and ready-to-serve beverages" was carried out with the following objectives :

1. To study the physico-chemical properties of different guava varieties.
2. To assess the quality of guava nectar and ready-to-serve (RTS) prepared from different varieties.
3. To standardize the recipe for guava nectar and ready-to-serve (RTS) beverages prepared from different guava varieties.
4. To find out the quality and shelf-life of guava nectar and ready-to-serve (RTS) beverage during storage under ambient condition.

CHAPTER-III

MATERIALS AND METHODS

The present investigation entitled "Evaluation of guava (*Psidium guajava* L.) varieties for processing into nectar and ready-to-serve beverages" was conducted in the Department of Horticulture, College of Agriculture, Indira Gandhi Agricultural University, Raipur (C.G.) during the year 2003-04. Two separate experiments were carried out to study the storage stability of guava nectar and ready-to-serve beverage at ambient temperature. The details regarding materials used and techniques applied during the course of investigation have been described in this chapter.

3.1 Geographical situation

Raipur is situated in the central part of the Chhattisgarh and lies at 21.16^0 N latitude and 81.36^0 E longitude at an altitude of 298 metres above the mean sea level under Chhattisgarh plains.

3.2 Climate

Raipur district comes under dry sub-humid agro-climatic region. It has annual rainfall of 1200-1400 mm, out of which about 85 per cent are received from third week of June to mid of September and very little during October to February. May is the hottest month and December the coolest. The maximum temperature goes as high as 46°C during summer and minimum as low as 6°C during winter months. The atmospheric humidity is high from June to September.

3.3.1 Weather condition during storage period

The weather data recorded during the period of investigation are given in Table 3.1 and depicted through Fig.3.1.

3.4 Experimental details

Crop	:	Guava
Processed products	:	Nectar and RTS
Design of experiment	:	Completely Randomized Design (factorial arrangement)
Number of replication	:	Three
Number of treatments	:	
Cultivars	:	Four
Recipes	:	Six
Number of treatment-combinations	:	Twenty four
Storage of products	:	For 150 days at ambient condition
Chemicals used	:	Analar quality

3.5 Treatment details

The experiment consists of 24 treatment combination each for nectar and RTS with three replication. The detail of treatments are given below.

Treatment combination

A . Cultivars : Four

V_1 – Apple Colour (AC) V_2 – Allahabad Safeda (AS)

V_3 – Lucknow-49 (L-49) V_4 – Rewa-72 (R-72)

B . Recipes : Six

For nectar		For RTS	
No.	Recipe	No.	Recipe
T_1	20% pulp, 0.3% acidity and 15% TSS	T_1	10% pulp, 0.3% acidity and 10% TSS
T_2	20% pulp, 0.3% acidity and 16% TSS	T_2	10% pulp, 0.3% acidity and 11% TSS
T_3	20% pulp, 0.3% acidity and 17% TSS	T_3	10% pulp, 0.3% acidity and 12% TSS
T_4	20% pulp, 0.3% acidity and 18% TSS	T_4	10% pulp, 0.3% acidity and 13% TSS
T_5	20% pulp, 0.3% acidity and 19% TSS	T_5	10% pulp, 0.3% acidity and 14% TSS
T_6	20% pulp, 0.3% acidity and 20% TSS	T_6	10% pulp, 0.3% acidity and 15% TSS

3.6 Experimental trees

Fifteen year old plants of four guava cultivars were used as experimental material. Healthy and vigorous plants free from infestation of insect-pest and diseases were selected for present studies. All the experimental trees were provided same cultural practices with four cultivars.

3.7 Preparation of guava nectar and RTS beverages

3.7.1 Selection of fruits

Firm ripe fruits were selected for the preparation of guava nectar and RTS beverages. The fruits were washed in running tap water to remove dirt and dust particles. They were sliced into small pieces.

3.7.2 Extraction of pulp

The slices were blended by adding equal amount of warm water in a waring blender. The whole mass was then sieved to obtain a fine fruit pulp devoid of seeds and skin.

3.7.3 Mixing the ingredients

After extraction of pulp, 20 per cent pulp for nectar and 10 per cent pulp for RTS was taken. The volume of the final product was maintained by adding water to each cultivar and recipe combination in each replication. A calculated amount of sugar was added in the pulp to adjust the total soluble solids as 15, 16, 17, 18, 19 and 20 per cent in the recipe for nectar and as 10, 11, 12, 13, 14, and 15 per cent for RTS. The acidity was maintained to 0.3 per cent in the final product by the addition of required amount of citric acid.

3.7.4 Filtration

The prepared nectar and RTS beverages were again filtered by sieving through a muslin cloth to obtain a product of uniform consistency.

3.7.5 Bottling

The product was poured into hot, sterilized crown bottles of 250 ml capacity and corked air-tight.

3.7.6 Pasteurization

The filled bottles were pasteurized in boiling water till the temperature of product reaches 100^0C. It took about 15 minutes to attain required temperature.

3.7.7 Storage

The bottles of nectar and RTS beverages were kept at ambient condition for further studies upto 150 days.

3.8 Observations recorded

3.8.1 Physical composition of fruits

Physical composition of ten mature fruits randomly selected under each replication and cultivar were studied at harvest stage. Five fruits

constituted as a unit. Thirty fruits were taken to record observations on the following characters.

3.8.1.1 Weight of fruit (g)

At the time of fruit picking, individual fruits were randomly selected under each cultivar and weighed separately on sensitive electronic balance and mean value of ten fruits in each replication was recorded in gram.

3.8.1.2 Weight of non-edible waste (g)

The upper and basal non-edible portion of individual fruit was removed and weighed separately on sensitive electronic balance and mean value of ten fruits in each replication was recorded.

3.8.1.3 Weight of peel (g)

The pulp-free peel of individual fruits under each cultivar was weighed separately on sensitive electronic balance and mean value of ten fruits in each replication was recorded in gram.

3.8.1.4 Weight of seeds (g)

The pulp-free seeds of individual fruit of each cultivar were weighed separately and average seed weight of ten fruits in each replication was recorded.

3.8.1.5 Weight of pulp (g)

The pulp weight of individual fruits under each cultivar was calculated by subtracting the weight of seeds, peel and non-edible waste from the weight of the whole fruit and mean value of ten fruits under each replication was recorded.

3.8.1.6 Number of seeds per fruit

The pulp-free seed of individual fruits in each cultivar were counted separately and average number of seeds with ten fruits in each replication was recorded.

3.8.1.7 Pulp : seed ratio

The pulp / seed ratio was calculated by dividing the weight of pulp by weight of seed.

3. 8.2 Chemical composition of fruits, nectar and RTS

Chemical composition of ten mature fruits randomly selected under each replication and cultivar were studied at harvest stage.

Chemical analysis of guava nectar and RTS beverages was done initially just after preparation and upto six months at 30 day interval during storage under ambient condition.

3.8.2.1 Ascorbic acid (mg/100 ml)

The ascorbic acid of pulp, nectar and RTS were determined by the procedure given by Ranganna (1997).

Reagents

1. 3% metaphosphoric acid (HPO_3) aqueous.
2. Standard ascorbic acid : 1% *L*-ascorbic acid in metaphosphoric acid solution.
3. Dye solution : 2, 6-Dichlorophenol-indophenol in alkaline solution.

Estimation

Five ml *L*-ascorbic acid solution with same amount of HPO_3 was titrated against 2, 6-dichlorophenol-indophenol. The end point was judged by light pink colour. The dye factor was determined as follows:

$$\text{Dye factor} = \frac{0.5}{\text{Titre}}$$

Standard ascorbic acid solution with HPO_3 solution was titrated against the dye solution till the pint colour appears. This method was repeated for fruit pulp, nectar and RTS beverage. The ascorbic acid was expressed as mg/ 100 ml.

$$\text{mg of ascorbic acid per 100 g or ml of sample} = \frac{\text{Titre} \times \text{Dye factor} \times \text{Volume made up} \times 100}{\text{Aliquot of extract taken for estimation} \times \text{Weight or volume of sample taken for estimation}}$$

3.8.2.2 Acidity

The acidity of pulp, nectar and RTS was determined by the procedure given by Ranganna (1997). Total acid content was estimated by titrating 10 g of fruit pulp or 10 ml of nectar and RTS against standard solution of N/10 NaOH using phenolphthalein as an indicator. The end point appeared as light pink colour. The acidity was expressed in per cent.

$$\text{Acidity (\%)} = \frac{\text{Titre} \times \text{Normality of alkali} \times \text{Volume made up} \times \text{Equivalent wt of acid} \times 100}{\text{Vol. of sample taken for estimation} \times \text{Wt or volume of sample taken} \times 1000}$$

3.8.2.3 pH

The pH value of fruit pulp, nectar and RTS were taken on digital pH meter.

3.8.2.4 Total soluble solids (%)

Total soluble solids (TSS) of pulp, nectar and RTS was determined by Hand Refractometer at 20^0C.

3.8.2.5 Sugars

Sugars was determined by the method of Lane and Eynon as described by Ranganna (1997).

Reagents

1. Fehling's solution A : Copper sulphate 69.28 g and volume made upto one litre.
2. Fehling's solution B : Potassium sodium tartrate 346 g and sodium hydroxide (NaOH) 100 g and volume made up to one litre.
3. Methylene blue indicator : Methylene blue 1% aqueous.
4. Neutral lead acetate (45%) solution.
5. Potassium oxalate (45%)solution.
6. Standard invert sugar solution : AR sucrose 9.5 g and concentrate HCl 5 ml and volume made upto 100 ml.

This solution is allowed to stand for further three days at 20-25^0C for inversion to take place and can be used for several months during analysis.

Twenty five ml of invert sugar solution was taken in a flask and added 50 ml distilled water, then neutralized with 20% NaOH in the presence of phenolphthalein as an indicator until the solution turned into pink colour. Then

acidified with 1 N HCl till pink colour disappears. The volume was made upto mark with distilled water (1 ml = 2.5 ml of invert sugar).

A. Reducing sugar

Estimation

A fixed quantity of filtered juice was transferred into volumetric flask and added same quantity of distilled water and neutralized with alkali solution. In this solution a fixed quantity of lead acetate solution was added, shaked and let it stand for some time and necessary amount of potassium oxalate solution was added. This process is necessary to get clarified solution.

Five ml fehling's solution A and fehling's solution B was taken in a conical flask. Burette was filled with sugar solution. Conical flask was heated in a open flame. Two to four ml sugar solution was poured and 1-2 drop of methylene blue indicator was added. Now, this solution was kept for heating and sugar solution was added to it. The end point appeared with brick-red colour. The reducing sugar was expressed in per cent.

$$\text{Reducing sugars (\%)} = \frac{\text{mg of invert sugar} \times \text{Dilution} \times 100}{\text{Titre} \times \text{Wt. or Volume of the sample} \times 1000}$$

B. Total sugar

Estimation

Fifty ml clarified sugar solution was added to 5 g of citric acid with 50 ml distilled water. It was boiled slowly for 10 minutes, cooled and transferred into a 250 ml volumetric flask and neutralized with NaOH with

phenolphthalein indicator and made up the volume. Titre was expressed as per cent reducing sugars. The total sugar was expressed in per cent.

Total sugar (%) = % reducing sugar (in which the titre is obtained after inversion) + % Sucrose.

C. Non- reducing sugar

Non-reducing sugar was determined by subtracting the value of reducing sugar from total sugar.

3.9 Organoleptic evaluation

The nectar and RTS beverages prepared from four cultivars of guava were subjected to sensory evaluation by a panel of five judges following the Hedonic rating test as described by Ranganna (1997). The products were evaluated for appearance, flavour, and taste.

The characters with mean scores of 5 or more out of 9 marks were considered acceptable. The overall acceptability of products was based upon the mean scores obtained from all these characters studied under the test. The product with an overall mean score of 15 or above was considered acceptable. The mean scores obtained by different products were calculated.

3.10 Statistical analysis

Data recorded on various aspects in the laboratory were subjected to statistical analysis of variance technique as given by Panse and Sukhatme (1985).

CHAPTER-II

REVIEW OF LITERATURE

Some efforts have been made on the utilization of various fruits for the preparation of different processed products and methods have been adopted for the processing of guava as jelly, jam, canning, juice concentrate, dehydrated slices, fruit bar and powder etc. However, the information regarding preparation of ready-to-serve and nectar beverages from guava fruits is limited. Therefore, the experiment entitled "Evaluation of guava (*Psidium guajava* L.) varieties for processing into nectar and ready-to-serve beverages" was conducted during the year 2003-04. A review of literature relevant to present investigation on various aspects is briefly described in this chapter to correlate the findings of the present experiment.

2.1 Physico-chemical composition of guava fruits at harvest

2.1.1 Physical composition of fruit

Ojha *et al.* (1987) observed seasonal variation in the physical characters of guava fruits in two guava cultivars i.e., Sardar and Allahabad Safeda. They reported that the size and weight of fruits were more in winter season crop as compared to rainy season crop. The fruits of cultivar Sardar were superior over Allahabad Safeda with regard to size and weight of fruit during both cropping season. The rainy season fruits produced more number of seeds per fruit as well as more seed weight per kg of fruit than the fruits harvested during winter

season. The cultivar Sardar produced less number of seeds and also less weight of seed per kg of fruit than Allahabad Safeda during both the cropping season.

Pandey and Singh (1998) studied the physical composition of fruits of four important varieties (Sardar, Allahabad Safeda, Apple Colour and Sangam) of guava and observed that the pulp content was highest in Allahabad Safeda followed by Sardar guava, the seed per cent was highest in Sangam followed by Apple Colour and the percentage of non-edible waste was highest in Apple Colour followed by Allahabad Safeda.

2.1.2 Chemical composition of fruit

Guava bears mainly two crops in a year i.e., winter and rainy season crop. The fruits of rainy season crop are larger in size than winter season as reported by various workers (Sachan *et al.*, 1969; Chundawat *et al.*, 1976; Singh and Rajput, 1977). They further observed that the total soluble solids, total sugars, acidity, pectin and ascorbic acid content were higher in winter guava fruits than that of rainy season fruits.

Singh and Rajput (1977) also observed highest TSS (11.59%), ascorbic acid (234 mg/100 g), total sugars (7.82%), reducing sugars (4.6%) and pectin (0.82%) in guava fruits, when 4 per cent urea spray was applied to the plants. There was an abrupt increase in total soluble solids, reducing sugars, total sugars and ascorbic acid content from mature to ripe stage, whereas maximum ascorbic acid content and acidity was observed at ripe stage. The total pectin was found to be maximum at the maturity of fruits and gradually it decreased as the fruits over-ripened.

Rajput *et al.* (1977) reported that guava fruits contained 9.9 per cent total soluble solids, 1.0 per cent acidity, 8.0 per cent total sugar, 5.05 per cent reducing sugar, 0.62 per cent pectin and 195 mg ascorbic acid per 100 gram pulp of fruit.

Bagging (Wrapping) of guava fruits with parchment paper improved the quality as compared to unbagged control (Chundawat *et al.*, 1978). They further reported that the composition of guava fruits of different cultivars vary with cultivar to cultivar and observed 13.3 to 15.1 per cent total soluble solids, 0.572 to 0.832 per cent acidity, 278.33 to 351.73 mg ascorbic acid per 100 g pulp, 3.82 to 4.45 per cent reducing sugar and 2.09 to 4.19 per cent non-reducing sugar content.

Mehta and Tomar (1980) observed 10 per cent total soluble solids, 76.9 per cent moisture, 0.42 per cent acidity, 5.76 per cent total sugars, 3.68 per cent reducing sugar, 1.04 per cent pectin and 291 mg ascorbic acid per 100 g of guava fruits.

Pandey and Singh (1998) studied the chemical composition of fruits of four important varieties (Sardar, Allahabad Safeda, Apple Colour and Sangam) of guava and observed that the fruits contained 12.10 to 14.20 per cent total soluble solids, 149 to 250 mg per 100 g ascorbic acid, 3.59 to 5.32 per cent non-edible waste, 2.44 to 3.58 per cent seed and 0.40 to 0.59 per cent acidity.

Kalsi *et al.* (2002) studied the composition and recovery of fresh guava juice. They observed that recovery of raw juice ranged from 62 to 66 per cent, whereas the recovery of clear juice was 51 to 57 per cent. The juice contained total soluble solids, total sugars and reducing sugar 8.5, 6.9 and 5.5 per cent,

respectively. Total acid content (as citric acid) was found to be 0.7 per cent and ascorbic acid content was 53 to 60 mg per cent. The initial browning of juice expressed as optical density was 0.0506. Similarly, Bons and Dhawan (2003b) also observed the composition and recovery of fresh guava juice.

2.2 Processed fruit products

Khurdiya (1980) observed that ready-to-serve (RTS) beverage prepared from dried ber contained 33.3 per cent juice having a pH of 3.75, 19.6^0 Brix and 0.56 per cent acidity. The *ber* juice after processing at 80^0C for 10 minutes stored well for 9 months at room temperature (20-30^0C) and the beverage was organoleptically acceptable.

The RTS beverage of *phalsa* juice with a Brix/acid ratio of 25.0 was liked best by a panel of seven judges (Khurdiya and Anand, 1981). Low temperature storage prolongs the storage life of fruit products. Kalra and Revethi (1981) noticed that guava pulp under refrigeration stored much longer as against at room temperature. After six months, pulp was utilized for juice preparation which was having a good quality.

Sarmah *et al.* (1981) observed that Kinnow juice had 13.5^0 Brix, 0.65 per cent acidity as citric acid and 25 mg ascorbic acid per 100 ml. The juice preserved with sulphur di-oxide had superior colour, flavour and higher retention of ascorbic acid as compared to heat-processed juice over a period of 28 weeks of storage.

Pasteurized mango pulp in polypropylene pack had a shelf life of three months at 5^0C and two months at 37^0C, while both mango pulp and syrup

preserved with sulphur di-oxide retained a better quality and having a shelf life atleast five months under ambient temperature (Ghosh *et al.*, 1982).

2.3 Standardize recipe for guava nectar

Guava nectar having composition of 20 per cent pulp, 20 per cent total soluble solids and 0.3 per cent acidity was considered as a good nectar (Kerure and Kjedkar, 1982).

Singh and Dhawan (1983) reported that an ideal nectar of papaya and guava fruits should contain 20 per cent pulp, 14 per cent total soluble solids and 0.3 per cent acidity.

2.4 Standardize recipe for nectar of other fruits

Roy *et al.* (1972) standardized the preparation of mango nectar with 20 per cent mango pulp, 20 per cent total soluble solids and 0.3 per cent acidity.

Canned mango nectar was prepared having 20 per cent pulp, 15 per cent total soluble solids with 0.3 per cent acidity (Shetty *et al.*, 1978).

Singh and Dhawan (1983) observed that an ideal recipe for preparation of mango nectar should have 20 per cent pulp, 14 per cent total soluble solids and 0.3 per cent acidity.

Rabbani and Singh (1988) reported that composition of 20 per cent juice, 14 per cent total soluble solids and 0.3 per cent acidity was found to be ideal for mango nectar.

Singh (1990) reported that 20 per cent mango pulp, 20^0 brix and 0.3 per cent acidity served as an ideal recipe for nectar.

According to Roy and Singh (1979), preparation of bael fruit nectar having 35 per cent pulp, 20 per cent total soluble solids and 0.3 per cent acidity

served as an ideal recipe. However, they further reported that the pulp content beyond 30 per cent made the product a bit thicker.

Singh and Dhawan (1983) reported that 20 per cent juice, 15 per cent total soluble solids and 0.3 acidity was found to be an ideal recipe for the preparation of nectar from *jamun* fruits.

Khurdiya and Roy (1984) reported that nectar with composition of 20 per cent *jamun* juice, 16.3 per cent total soluble solids and 0.52 per cent acidity was considered as an ideal recipe.

Singh (1988) reported that 20 per cent juice and 15 per cent total soluble solids with 0.3 per cent acidity was found suitable for making nectar of litchi fruits.

Vyas *et al.* (1989) observed that during standardization of juice extracted from petals of *Rhododendron* flowers for preparation of refreshing nectar, a combination having 20 per cent juice, 15^0 Brix (TSS), 0.3 per cent acidity alongwith strawberry and raspberry flavour (mixed in 1:1 at 400 ppm level) and carmosine colour at 20 ppm was found to be the most flavoured blend.

2.5 Standardize recipe for guava RTS

Ready-to-serve is a type of fruit beverage which contains at least 10 per cent juice, 10 per cent total soluble solids and desirable amount of acidity.

According to F.P.O. specification, juice content should not be less than 10 per cent, whereas the juice content and TSS should not be less than 5 and 10 per cent, respectively in case of lime fruits. The preservatives used as sulphur di-oxide and benzoic acid should not be more than 70 and 150 ppm, respectively.

Jain and Broker (1970) prepared ready-to-serve beverage from guava fruits containing high pulp and suggested that the addition of ascorbic acid greatly improved the flavour.

Harnanan *et al.* (1980) reported that ready-to-serve beverage of guava fruits with 20 per cent pulp, 12 per cent total soluble solids and 0.4 per cent acidity was an ideal recipe.

Singh and Dhawan (1983) observed that ready-to-serve beverage with composition 10 per cent pulp, 15 per cent total soluble solids and 0.3 per cent acidity was found to be ideal for guava fruits.

Bons and Dhawan (2003a) reported that guava ready-to-serve beverage was prepared with 15 per cent pulp, 14 per cent total soluble solids, 0.28 per cent acidity and 0.05 per cent carboxymethyl cellulose (CMC).

2.6 Standardize recipe for RTS of other fruits

Shetty *et al.* (1978) observed that mango ready-to-serve (RTS) having composition of 10 per cent acidity was suitable. They further reported that beverage thus prepared was filled into sterilized bottles and pasteurized for 30 minutes at 75^0C, air-cooled and stored.

Singh and Dhawan (1983) reported that 10 per cent mango pulp, 15 per cent total soluble solids and 0.3 per cent acidity was found an ideal recipe for mango ready-to-serve beverage.

Rabbani and Singh (1988) reported that mango ready-to-serve beverage with composition 10 per cent pulp, 14 per cent total soluble solids and 0.3 per cent acidity was found to be ideal.

Singh (1988) reported that 10 per cent juice and 14 per cent total soluble solids with 0.3 per cent acidity was found suitable for ready-to-serve making from litchi fruits.

Kotecha *et al.* (1995) reported that the RTS beverage of custard apple prepared by using different levels of juice (10, 15, 20 and 25%) contained 15 per cent total soluble solids and 0.25 per cent acidity.

Jain *et al.* (1996) reported that mango ready-to-serve beverage prepared with 10 per cent pulp, 14 per cent total soluble solids and 0.3 per cent acidity was heated to 85^0C, filled hot into clean and sterilized glass bottles of 200 ml capacity and sealed with crown cork immediately. The filled bottles were pasteurized in boiling water for 15 minutes and then cooled in air and stored at room temperature.

Shrivastava (1998) reported that mango ready-to-serve beverage was prepared having a composition of 15 per cent pulp, 14^0 Brix and 0.25 per cent acidity.

2.7 Change of chemical composition in beverages

2.7.1 Ascorbic acid

The demand of fruit beverages is mainly based on their nutritive value, flavour, aroma and colour. The beverages are a good source of vitamins, minerals, carbohydrate, amino acids, flavonoid compounds and probably other unidentified constituents.

Sethi *et al.* (1980) reported that 29.95 to 17.64 mg ascorbic acid per 100 ml orange juice lost when stored at room temperature for 9 months. The decrease in ascorbic acid content of preserved (heat processing) orange juice

was linear with increasing storage time at room temperature, but the losses of ascorbic acid during storage for 4 months at the temperature of 30 ± 3°C were negligible.

Harnanan *et al.* (1980) reported that the retention of ascorbic acid was the highest in the canned guava pulp as compared to that of the chemically preserved pulp.

Seventeen cultivars of mango were examined by Awasthi and Pandey (1980) for physico-chemical composition and suitability for canning and observed that 40-48 per cent ascorbic acid was retained in canned products after 6 months of storage.

The losses of ascorbic acid in the heat-processed bottled juice were higher than the juice preserved with sulphur di-oxide. Sethi and Anand (1982) observed that carrot and *aonla* preserve had very low vitamin C as compared to fresh fruit vitamin C content. Similarly, Ranote and Bains (1982) noticed that ascorbic acid content of Kinnow juice decreased with processing and storage. The retention of ascorbic acid in sulphur di-oxide preserved juice was higher as compared with heat-processed bottled juice. The pH had no effect on ascorbic acid retention.

Baramanray *et al.* (1995) observed that ascorbic acid content (mg/100 g pulp) in guava nectar decreased significantly ($P < 0.01$) with increasing storage period. During 90 days of storage, it was found to be reduced by 18 per cent amounting to 0.0092 mg per 100 ml per day ($r = 0.991$).

Pandey and Singh (1998) observed that ascorbic acid (vitamin C) content of guava squash decreased continuously during storage at room

temperature. The losses in ascorbic acid content of fruit beverage has also been noticed in papaya (Kumar, 1990) and mango (Rabbani, 1992) beverage during storage at ambient temperature.

Bons and Dhawan (2003a) observed a reduction of ascorbic acid in the fresh and preserved guava pulp during storage with maximum reduction in the pulp stored at room temperature. Whereas, minimum reduction of ascorbic acid was observed in the pulp treated with KMS 0.07 per cent and stored at freezing temperature. The ascorbic acid content was found to be higher (24.3 mg %) in RTS beverage prepared from pulp treated with heat + KMS 0.1% and stored at low temperature (LT) followed by beverage prepared from pulp treated with heat + KMS 0.07% stored at freezing temperature (FT).

Bons and Dhawan (2003b) also observed that retention of ascorbic acid was higher in guava juice concentrate prepared with vacuum concentration method as compared to open pan concentration. Under vacuum concentration, the concentrated juice having 55°B had the maximum ascorbic acid content (42.39 mg%). The retention of ascorbic acid was minimum (23.37 mg%) in open pan concentration at 45°B. The ascorbic acid content decreased significantly upto 90 days of storage. However, a reduction of about 50 per cent in ascorbic acid during first 30 days of storage was observed.

2.7.2 Acidity

In general, the acidity of fruit products is increased with the duration of storage but when product is cooked to a higher consistency, a decrease in acidity is observed. The total titrable acidity of *aonla* juice increased more

rapidly in the samples stored for 10 weeks at room temperature than those stored in refrigeration (Mehta and Rathore, 1976). Similarly, Sethi *et al.* (1980) also reported an increase in acidity from 1.35 to 2.35 per cent after nine months of storage of orange juice.

The acidity and pH of dried *ber* juice remained constant during storage at room temperature for 90 days (Khurdiya, 1980).

Godara and Pareek (1985) observed that the total acid content slightly increased when the date juice RTS beverage was stored for 148 days.

Baramanray *et al.* (1995) observed that the titrable acidity in guava nectar increased significantly ($P < 0.01$) with the increase in storage period.

Kalsi and Dhawan (2001) reported that a significant increase in the acidity of guava fruit bar was recorded with all the cultivars during storage. Initially, it was found to be 1.31 per cent which increased to 2.06 per cent after 60 days of storage.

Bons and Dhawan (2003b) observed that the acid content decreased significantly from 3.93 to 0.53 per cent during storage at room temperature in guava juice concentrate under vacuum concentration and open pan concentration.

2.7.3 pH

Sethi (1993) observed that the physico-chemical changes were faster at room temperature (25-35°C) than low temperature (4-5°C). For long term storage (1 year) of litchi squash, low temperature storage was better. During six months of storage, there was not much change in the pH in different lots of litchi squash prepared with or without addition of ascorbic acid.

Barwal and Kalia (1998) observed that the pH of Kinnow juice increased during storage in all the treatments except control sample in which pH decreased after 90 days of storage.

Prasad and Mali (2000) also observed that physico-chemical changes took place in pomegranate squash during storage were faster at room temperature (25-40°C) than at low temperature (4-5°C). For long term storage (1 year) of squash, low temperature storage was better. There was not much change in the pH in both the lots during six months storage.

2.7.4 Sugars

An increase in reducing sugars was correlated with the decrease in non-reducing sugar content. According to Brekke *et al.* (1976), the decrease in sucrose content was correlated with an increase in reducing sugars in papaya nectar at storage temperature. The reducing sugar content of fruit products increased during storage at all storage temperature. Sulphur di-oxide preserved pulp showed maximum increase in reducing sugar content, whereas the non-reducing sugar followed a decreasing trend.

Harnanan *et al.* (1980), while studying the effect of several heat treatment on quality and shelf life of frozen nectar of guava reported that reducing sugar content of the pulp was found to be increased during storage. The increase was maximum in the pulp extracted either by the cold or hot method, but preserved with sulphur di-oxide.

Storage temperature affect the reducing sugars, total sugars and non-reducing sugars of stored products. A slight decrease in total soluble solids of dried ber juice was observed by Khurdiya (1980) during storage for 9 months at

room temperature. However, Khurdiya and Anand (1981) observed a gradual increase in reducing sugar content from 8.78 to 11.48 per cent during storage for 20 days at room temperature in *phalsa* beverage. The rate of increase in reducing sugars was much slower at 20^0C and 30^0C upto 100 days of storage. They also reported that temperature does not affect the total soluble solids and total sugar content of *phalsa* beverage during storage.

Sarmah *et al.* (1981) observed a considerable increase in reducing sugar content in single strength Kinnow mandarin juice in the samples at room temperature as compared to those kept at low temperature. Similar trend was observed in the values with toned juice. The amount of non-reducing sugars decreased considerably with storage, being more in those samples kept at room temperature than at low temperature.

The change in sugar content of the fruit products were affected by the temperature of processing and storage. Ranote and Bains (1982) reported that the reducing sugar content of Kinnow juice increased more in heat-processed samples irrespective of the season of picking. The changes were even more pronounced in the juice having natural pH of 3.5 as compared with adjusted pH to 4.0.

Ghosh *et al.* (1982) also reported an increase in reducing sugar content of mango pulp and mango syrup from 4.1 to 5.7 and 5 to 15 per cent, respectively at ambient temperature during 5 months of storage. They further reported that reducing sugar content of mango pulp remained constant at 5°C upto 3 months but it increased 8.0 to 9.0 per cent at ambient temperature of 37°C upto 3 months.

Shrestha and Bhatia (1982) observed practically no change in total soluble solids of apple juice during storage and found significant difference among the varieties. However, they reported that the reducing sugar content increased during storage and was found to be more at 37°C than at room temperature, while total sugars and specific gravity remained unchanged.

Sahni and Khurdiya (1989) studied the effect of storage temperature on mango nectar and observed a rapid increase in the values of reducing sugars at ambient temperature.

Baramanray *et al.* (1995) reported that there was a significant ($P<0.01$) increase in total sugars as well as reducing sugar content in stored guava nectar with increasing storage period. The increase in total sugar was upto the level of 48.8 per cent at 90 days of storage. The increase in reducing sugar also corresponded with the increase in TSS and total sugars.

Shrivastava (1998) reported that reducing sugars increased during storage of mango pulp as well as mango ready-to-serve (RTS) drinks, while non-reducing sugar was found to be decreased.

Prasad and Mali (2000) observed that the changes occurred during storage were faster at room temperature (25 - 40^0C) than at low temperature (4-5^0C). For a longer storage (1-year) of pomegranate squash, low temperature storage was better. The low temperature storage did not much change the total sugar, while the level of reducing sugars increased but non-reducing sugars decreased during 6 months of storage.

Godara and Pareek (1985) reported that the total soluble solids and total sugars increased slightly under storage at 13.2°C as well as at room temperature (25 $\pm$

5°C). The reducing sugar also increased and there was a corresponding decrease in non-reducing sugar during 5 months of storage life of date juice RTS beverage.

Kalsi *et al.* (2002) observed that the total sugar and reducing sugar contents were maximum in vacuum concentration than open pan concentration method of guava juice concentrate.

Bons and Dhawan (2003b) reported that no significant increase in total sugar was observed initially in guava juice concentrate and thereafter, a significant increase in sugars was noticed during 30 to 90 days of storage.

2.8 Organoleptic evaluation

The demand of fruit beverage is largely based on their nutritive values, flavour, aroma and colour. These beverages are good source of vitamins, minerals, carbohydrates, amino acid, flavonoid compounds and many other constituents.

A ready-to-serve beverage of *ber* having 33.3 per cent juice and 20.8° Brix with acidity of 0.5 per cent was liked moderately by the panel of ten judges (Khurdiya, 1980).

Sulphur di-oxide also improved the quality of fruit slices during storage. Metha and Tomar (1980) observed that guava slices steeped in 70°Brix syrup containing 1000 ppm sulphur di-oxide gave the best product. But, the retention of ascorbic acid was only upto six per cent.

The temperature affects the colour retention of RTS beverage during storage. Khurdiya and Anand (1981) observed that the colour in *phalsa*

beverage was best retained at 3°C followed by 20°C at room temperature. The acceptability of beverage goes down when stored above 20°C at room temperature.

Grewal and Jain (1982) revealed that there was maximum organoleptic acceptability of 1:4 ratio (mango pulp : separated milk) with decreasing order of acceptability 1:3, 1:5 and 1:2 ratio.

Sethi (1993) observed that all the samples of litchi squash were found to be organoleptically acceptable at low temperature as compared to room temperature.

Baramanray *et al.* (1995) observed the organoleptic quality of guava nectar and found that the hybrids were superior to established cultivars. On an average, hybrids 3-22 and 5-27 were found to be best suitable so far as the acceptability is concerned. However, quality deteriorated ($P<0.01$) with the increase in storage time irrespective of varieties and hybrids. After 90 days of storage, the nectar prepared from hybrids had better acceptability than established varieties. Amongst the commercial cultivars, Allahabad Safeda was found to be best.

Thakur and Barwal (1998) observed a considerable decrease in sensory mean score for taste, flavour and over all acceptability in the squash of *kiwi* fruit during storage. The sensory mean score for each attribute was highest on the day of preparation, which decreased with the passage of time in storage.

Pandey and Singh (1998) reported that organoleptic quality determines the storage stability of the product. There is gradual decrease in the

organoleptic quality of guava squash and it was found acceptable upto six months.

Dwivedi and Mitra (2000) observed the orgnoleptic evaluation of litchi squash and cultivar Bedana was found to be best. The squash prepared from the fruits of cultivar Bedana scored highest value of 7.5 followed by Bombai (7.0). All the other cultivars had poor organoleptic value of 6.5.

Kalsi and Dhawan (2001) observed that the organoleptic rating of guava fruit bar obtained highest score by cv. Allahabad Safeda (32.50) and minimum by hybrid H-25-25 (26.83). During storage, a significant reduction in organoleptic rating was also observed.

Bons and Dhawan (2003a) observed that organoleptic evaluation of guava RTS beverage showed maximum score (32.5) when prepared from the pulp treated with KMS 0.07 per cent and stored at freezing temperature (FT) followed by a score of 31.8 in the beverage prepared from the pulp treated with KMS 0.1 per cent at low temperature (LT). These beverages were comparable with the beverage prepared from fresh guava pulp.

CHAPTER-IV

EXPERIMENTAL FINDINGS

The data recorded on various aspects in respect to processing of guava varieties into nectar and ready to serve (RTS) beverages during the course of investigation are elucidated in this chapter alongwith tables and suitable illustrations under the following heads :

4.1 Physico-chemical composition of guava fruits at harvest.

4.2 Biochemical changes in guava nectar during storage.

4.3 Organoleptic evaluation of guava nectar during storage.

4.4 Biochemical changes in guava RTS during storage.

4.5 Organoleptic evaluation of guava RTS during storage.

4.1 Physico-chemical composition of guava fruits at harvest

Data pertaining to physico-chemical composition of fruits in different guava cultivars at harvest are presented in Table 4.1.

Data showed that there was a great variation in physical composition of four guava cultivars i.e., Apple Colour, Allahabad Safeda, L-49 and R-72. The weight of guava fruits varied from 107.76 g (Apple Colour) to 188.71 g (L-49). The cultivar Allahabad Safeda and R-72 recorded 112.14 g and 175.05 g weight of fruit, respectively. The weight of pulp was found to be maximum in the cultivar L-49 (163.34 g) followed by R-72(148.91 g), Allahabad Safeda (94.18 g) and Apple Colour (93.48 g). The peel weight was also recorded highest in the cultivar L-49 (15.64 g) followed by R-72 (14.31 g),

Allahabad Safeda (11.34 g) and Apple Colour (9.4 g). The weight of non-edible waste was found to be maximum in the cultivar R-72 (5.24 g) followed by L-49 (4.58 g), Allahabad Safeda (3.12 g) and Apple Colour (3.08 g). The seed weight was recorded highest in R-72 (6.59 g) followed by L-49 (5.08 g), Allahabad Safeda (3.88 g) and Apple Colour (3.75 g). The number of seeds per fruit was found to be more in R-72 (667) followed by L-49 (540), Apple Colour (476) and Allahabad Safeda (379). The pulp and seed ratio was observed maximum in L-49 (32.02) followed by Allahabad Safeda (26.31), Apple Colour (25.95) and R-72 (22.64).

Data in respect to chemical composition of fruits at harvest stage revealed that total soluble solids (TSS) varied from 11.32 per cent (Apple Colour) to 14.53 per cent (L-49). The cultivars R-72 and Allahabad Safeda had 13.09 and 13.49 per cent TSS, respectively. A marked variation in the total sugar, reducing and non-reducing sugar was observed in fresh fruit pulp of all the cultivars. The total sugar content ranged from 9.23 to 11.63 per cent in the cvs. Apple Colour and L-49, respectively. Reducing sugar content was found to be higher in L-49 (6.62%) followed by R-72 (6.53%), Allahabad Safeda (6.46%) and Apple Colour (4.73%). Non reducing sugar content ranged from 3.53 per cent (R-72) to 5.05 per cent (L-49). The cultivars Allahabad Safeda and Apple Colour contained 3.77 and 4.49 per cent non-reducing sugar, respectively. The highest ascorbic acid content was observed in the cultivar L-49 (366.50 mg/100 g pulp) followed by Allahabad Safeda (332.10 mg/100 g pulp), Apple Colour (241.40 mg/100 g pulp) and R-72 (135.25mg/100g pulp). Total titrable acidity was found to be higher in the fruit pulp of cultivar

R-72 (0.94%) followed by L-49 (0.76%), Apple Colour (0.64%) and Allahabad Safeda (0.49%). The pH values were also observed and found to be higher in the fruit pulp of cv. Allahabad Safeda (5.52) followed by L-49 (5.51), Apple Colour (4.87) and R-72 (4.25).

4.2 Biochemical changes in guava nectar during storage

4.2.1 Ascorbic acid

Data pertaining to ascorbic acid as influenced by different recipes as well as cultivars under storage condition of guava nectar are presented in Table 4.2 and illustrated in Fig. 4.1.

It is evident from the data that ascorbic acid content in guava nectar showed a decreasing trend with increasing period of storage (0 to 150 days) under all the treatments of cultivars and recipes. The ascorbic acid was found to be highly significant between cultivars from 0 to 150 day of storage. The acid content was observed significantly higher in the cultivar L-49 (6.17 mg/ 100 ml) followed by Allahabad Safeda (5.58 mg/100 ml), Apple Colour (4.87 mg/100ml) and R-72 (4.27 mg/100 ml) at the time of preparation (0 day). Almost same trend was observed upto 150 days. At the end of 150 day of storage, guava nectar of cultivar L-49 contained maximum ascorbic acid (4.71 mg/100ml), which was significantly higher than Allahabad Safeda (4.00 mg/100 ml), Apple Colour (2.88 mg/100ml) and R-72 (2.35 mg/100 ml).

Further, it was observed that ascorbic acid content was significantly higher (6.58 mg/100 ml) in guava nectar with T_3 (20% pulp, 0.3% acidity and 17% TSS) than the other treatments of recipes, but minimum content (3.69 mg/100 ml) was recorded at the time of preparation (0 day) under T_5 (20%

pulp, 0.3% acidity and 19% TSS). Almost same trend of ascorbic acid was observed during storage upto 150 days. At the end of 150 day storage, guava nectar maintained supremacy with T_3 (20 % pulp, 0.3 % acidity and 17% TSS) by retaining 4.77 mg/100 ml ascorbic acid. While, minimum content (2.16mg/100ml) was recorded under T_5 (20% pulp, 0.3% acidity and 19% TSS).

The combined effect of treatments (cultivar X recipe) showed a decreasing trend of ascorbic acid in guava nectar from the time of preparation (0 day) to 150 day of storage. A significantly higher content of ascorbic acid (7.58 mg/100 ml) was observed in the cultivar L-49 with T_3 (20 % pulp, 0.3 % acidity and 17 % TSS) at the time of preparation. While, lowest content of ascorbic acid (2.25mg/100ml) was noted in the cultivar R-72 with T_5 (20% pulp, 0.3% acidity and 19% TSS). The same trend of ascorbic acid was observed during storage upto 150 days. At 150 day, maximum content of ascorbic acid (5.67 mg/100 ml) was observed in the cultivar L-49 under T_3 (20% pulp, 0.3% acidity and 17% TSS). Whereas, minimum ascorbic acid (1.13 mg/100ml) was recorded in the cultivar R-72 with T_5 (20% pulp, 0.3% acidity and 19% TSS) at the end of storage.

4.2.2 Acidity

Data pertaining to effect of various recipes on the acidity of stored guava nectar of four cultivars at ambient condition are presented in Table 4.3 and depicted in Fig. 4.2.

It is apparent from the data that acidity in guava nectar showed an increasing trend with all the cultivars and recipes at increasing period of storage (0 to 150 days). While, the acidity was not influenced significantly at the time of preparation with the cultivars. Thereafter, at 30 day of storage, the acidity was found to be increased significantly in the cultivar R-72 (0.46%) followed by Apple Colour (0.43%), Allahabad Safeda (0.34%) and L-49 (0.32%) and a similar trend was observed upto 150 days. At the end of 150 days of storage, guava nectar of cultivar R-72 contained maximum acidity (1.02%), which was significantly higher than Apple Colour (0.88%), Allahabad Safeda (0.78%) and L-49 (0.65%).

Due to effect of recipe treatments, it was observed that there was an increasing trend of acidity in guava nectar throughout the storage period (0 to 150 days). While, the acidity was not influenced significantly at the time of preparation with the treatments of recipe. Thereafter, at 30 day of storage, a significantly higher status (0.46%) was observed with T_6 (20% pulp, 0.3% acidity and 20% TSS). While, minimum (0.34%) acidity was recorded under T_3 (20% pulp, 0.3% acidity and 17% TSS). The same trend was observed upto 150 day of storage. At the end of storage, a significantly maximum (0.94%) acidity was found with T_6 (20% pulp, 0.3% acidity and 20% TSS). While, minimum (0.70%) content was noted with T_3 (20% pulp, 0.3% acidity and 17% TSS).

However, interaction effects between cultivar and recipe showed non-significant differences with respect to acidity in guava nectar upto 150 days during storage.

4.2.3 pH

The effect of various recipe on the pH of guava nectar prepared from four cultivars and stored at ambient temperature for 150 days was ascertained and the data are presented in Table 4.4 and depicted in Fig. 4.3.

The pH value of guava nectar stored at room temperature showed a decreasing trend with increasing period of storage (0 to 150 day) due to different recipe and cultivars. The pH value was observed significantly higher in the cultivar L-49 (4.78) followed by Allahabad Safeda (4.61), Apple Colour (4.27) and R-72 (3.95) at the time of preparation. Almost same trend was observed upto 150 days of storage. At the end of 150 day of storage, guava nectar of cultivar L-49 contained maximum pH value (3.94), which was significantly higher than Allahabad Safeda (3.55), Apple Colour (2.97) and R-72 (2.75).

Besides cultivars, the treatment (T_3) having recipe 20 per cent pulp, 0.3 per cent acidity and 17 per cent TSS in guava nectar recorded significantly maximum pH value from 0 to 150 day of storage. While on the other hand, minimum pH was assessed in guava nectar with T_6 (20% pulp, 0.3% acidity and 20% TSS).

However, interaction effects between cultivar and recipe showed a decreasing trend of pH in guava nectar with increasing period of storage upto 150 days. The pH value was found to be significantly higher (5.89) in the cultivar L-49 with T_3 (20% pulp, 0.3% acidity and 17% TSS), while lowest pH (3.20) was recorded in the cultivar R-72 under T_6 (20% pulp 0.3% acidity and 20% TSS) at the time of preparation. Almost same trend was observed upto 150 day of storage. At the end (150 day) of storage, the nectar of cultivar L-49

contained a high pH of 4.65 under T_3 (20% pulp, 0.3% acidity and 17% TSS). While, the minimum pH value (2.00) was noted in the cultivar R-72 with T_6 (20% pulp, 0.3% acidity and 20% TSS).

4.2.4 Total soluble solids (TSS)

The data pertaining to effect of various treatments (cultivar and recipe) on the total soluble solids of guava nectar stored at ambient temperature was recorded and presented in Table 4.5 and illustrated in Fig. 4.4.

It is apparent from the data that total soluble solids content in guava nectar showed an increasing trend with the cultivars at increasing period of storage (0 to 150 day). The TSS content was found to be highly significant between cultivars from 30 day to 150 day of storage. A non-significant difference in TSS content was observed between cultivars at the time of preparation. While, at 30 day of storage, the TSS was found to be significantly higher in the cultivar R-72 (17.83%) followed by Apple Colour (17.76%), Allahabad Safeda (17.68%) and L-49 (17.56%). Thereafter, a similar trend was observed upto 150 day of storage. At 150 day of storage, guava nectar of cultivar R-72 contained maximum TSS (18.04%), which was significantly higher than Apple Colour (17.92%), Allahabad Safeda (17.83%) and L-49 (17.72%).

Among the recipe treatments, TSS of guava nectar prepared with various recipes was found to be increased upto 150 day of storage. Similarly, significantly a higher (19.92%) content of TSS was observed under the treatment T_6 (20% pulp, 0.3% acidity and 20% TSS) at the time of preparation. While, a minimum level (15.00%) was noted with T_1 (20% pulp 0.3% acidity

and 15% TSS). Thereafter, almost same trend was observed upto 150 day of storage. At 150 day of storage, the nectar had significantly a higher (20.51%) TSS in the treatment T_6 (20% pulp, 0.3% acidity and 20% TSS). While, a minimum (15.35%) content was recorded under the treatment T_1 (20% pulp, 0.3% acidity and 15% TSS).

Similarly, the combined effect of treatments (cultivar X recipe) showed an increasing trend of TSS with increasing period of storage (0 to 150 days). While, the TSS was not influenced significantly at the time of preparation due to treatments of cultivar and recipe. Thereafter, it increased significantly and the level was found to be higher (20.45%) at 30 day of storage in the cultivar R-72 under T_6 (20% pulp, 0.3 acidity and 20% TSS) than the other recipe treatments. However, minimum (15.05%) TSS content was noted in the cultivar L-49 with T_1 (20% pulp, 0.3 acidity and 15% TSS). Further, almost same trend was observed upto 150 day of storage. At the end (150 day) of storage, a significantly higher TSS (20.68%) in guava nectar was observed in the cultivar R-72 with T_6 (20% pulp, 0.3% acidity and 20% TSS). While, minimum TSS (15.20%) content was assessed in the cultivar L-49 under the treatment T_1 (20% pulp, 0.3% acidity and 15% TSS).

4.2.5 Reducing Sugar

The reducing sugar content of guava nectar prepared from four cultivars with different recipes and stored at ambient condition was recorded and results are presented in Table 4.6 and depicted in Fig. 4.5.

It is evident from the data that reducing sugar content in guava nectar showed an increasing trend with all the cultivars and recipe treatment at

increasing period of storage (0 to 150 day). The reducing sugar was found to be highly significant between cultivars from the time of preparation (0 day) to 150 day of storage. The reducing sugar content was varied from 6.56 to 7.26 per cent in the cultivars L-49 and R-72, respectively at the time of preparation. A significant higher content was observed in the cultivar R-72 (7.26%) followed by Apple Colour (7.03%), Allahabad Safeda (6.77%) and L-49 (6.56%). Almost a similar trend was observed upto 150 day of storage. At the end of 150 day of storage, the cultivar R-72 contained maximum reducing sugar content (11.45%), which was significantly higher than Apple Colour (9.69%), Allahabad Safeda (9.43%) and L-49 (8.27%).

Among the recipe treatments, the nectar prepared with various recipes increased the level of reducing sugar from the time of preparation (0 day) to 150 day of storage. However, significantly a higher (9.77%) content of reducing sugar was observed with T_6 (20% pulp, 0.3% acidity and 20% TSS) at the time of preparation. While, minimum (4.33%) fraction of reducing sugar was noted in the treatment T_1 (20% pulp, 0.3% acidity and 15% TSS) at the same stage. Thereafter, almost same trend was observed upto 150 day of storage. At the end of 150 day of storage, guava nectar recorded significantly a higher (12.79%) level of reducing sugar under T_6 (20% pulp, 0.3% acidity and 20% TSS). Whereas, the minimum (7.09%) content was noted with T_1 (20% pulp, 0.3% acidity and 15% TSS).

The combined effect of treatments also showed an increasing trend of reducing sugar with increasing period of storage (0 to 150 days). Significantly a higher (10.10%) status of reducing sugar was observed at the time preparation

in the cultivar R-72 under the treatment T_6 (20% pulp, 0.3% acidity and 20% TSS) than the other recipe treatments. While, minimum (4.00%) reducing sugar content was found in the cultivar L-49 with T_1 (20% pulp, 0.3% acidity and 15% TSS) at initial assessment. Further, the same trend was observed upto 150 day of storage. At the end (150 day) of storage, a higher (14.43%) reducing sugar content was observed in the cultivar R-72 with T_6 (20% pulp, 0.3% acidity and 20% TSS). While, minimum (5.65%) content in the cultivar L-49 was noted under the treatment T_1 (20% pulp, 0.3% acidity and 15% TSS).

4.2.6 Total Sugar

Data with respect to total sugar as influenced by different treatments of recipe and cultivar under storage condition of guava nectar are presented in Table 4.7 and depicted in Fig. 4.6.

It is vivid from the data that total sugar content in guava nectar showed an increasing trend with all the cultivars and recipe treatments at increasing period of storage (0 to 150 days). Total sugar content was found to be highly significant between cultivars from the time of preparation (0 day) to 150 day of storage. A higher content of total sugar was observed in the cultivar R-72 (16.85%) followed by Apple Colour (16.75%), Allahabad Safeda (16.65%) and L-49 (16.55%) at the time of preparation. Thereafter, a similar trend was observed upto 150 day of storage. At the end of 150 day, guava nectar of R-72 contained maximum total sugar (17.28%), which was significantly higher than Apple Colour (17.23%), Allahabad Safeda (17.09%) and L-49 (17.00%).

Among the recipe treatments, the total sugar increased from the time of preparation to 150 day of storage in guava nectar prepared with various recipes.

A significantly higher (19.20%) content of total sugar was observed under T_6 (20% pulp, 0.3% acidity and 20% TSS) with a minimum (14.20%) value in T_1 (20% pulp, 0.3% acidity and 15% TSS) at the time of preparation. Further, almost same trend was observed upto 150 day of storage. At the end (150 day) of storage, guava nectar was analysed and recorded significantly a higher (19.87%) total sugar under the recipe T_6 (20% pulp, 0.3% acidity and 20% TSS). While, it was found to be minimum (14.61%) at T_1 having recipe 20 per cent pulp, 0.3 per cent acidity and 15 per cent TSS.

Similarly, the combined effect of treatments showed an increasing trend in total sugar with increasing period of storage (0 to 150 days). However, total sugar was not influenced significantly at the time of preparation and 30 day of storage with the combined effect of recipe and cultivars. But, it was found to be significantly higher (19.62%) at 60 day of storage in the cultivar R-72 under the recipe T_6 (20% pulp, 0.3% acidity and 20% TSS) than the rest of the treatments. While, minimum (14.16%) total sugar content was noted in the cultivar L-49 with T_1 (20% pulp, 0.3% acidity and 15% TSS). Thereafter, a similar trend was observed upto 150 day of storage. At 150 day of storage, the nectar contained significantly a higher total sugar (19.93%) in the cultivar R-72 with T_6 (20% pulp, 0.3% acidity and 20% TSS). While, minimum (14.46%) content was observed in the cultivar L-49 under the recipe T_1 (20% pulp, 0.3% acidity and 15% TSS).

4.2.7 Non-reducing Sugar

Non-reducing sugar in guava nectar as affected by various recipes as well as cultivars and stored at ambient temperature was ascertained and the data are presented in Table 4.8 and illustrated in Fig. 4.7.

It is evident from the data that non-reducing sugar in guava nectar showed a decreasing trend under all the cultivars and recipe with increasing period of storage (0 to 150 days). The non-reducing sugar content was found to be highly significant between cultivars from the time of preparation to 150 day of storage. The non-reducing sugar content was found to be higher in the cv. L-49 (9.99%) followed by Allahabad Safeda (9.89%), Apple Colour (9.72%) and R-72 (9.59%) at the time of preparation. Subsequently, a similar trend was observed upto 150 days. At the end of 150 day of storage, nectar of L-49 contained maximum non-reducing sugar (8.74%), which was significantly higher than Allahabad Safeda (7.66%), Apple Colour (7.54%) and R-72 (5.83%).

Further, the non-reducing fraction of sugar was found to be significantly higher (10.17%) in guava nectar prepared with the recipe T_3 (20% pulp, 0.3% acidity and 17% TSS) than rest of the recipe treatments, but minimum content (9.43%) was recorded at the time of preparation (0 day) with T_6 (20% pulp, 0.3% acidity and 20% TSS). Almost same trend of non-reducing sugar was observed during storage upto 150 days. At the end of 150 day storage, guava nectar with recipe T_3 (20% pulp, 0.3% acidity and 17% TSS) maintained higher (7.85%) non-reducing sugar. While, minimum non-reducing sugar (7.08%) was recorded under T_6 (20% pulp, 0.3% acidity and 20% TSS).

The combined effects of recipe and cultivar showed a decreasing trend of non-reducing sugar in guava nectar from the time of preparation to 150 day of storage. A significantly higher content of non-reducing sugar (10.30%) was observed in the cultivar L-49 with T_3 (20% pulp, 0.3% acidity and 17% TSS) at the time of preparation. Whereas, the minimum content (9.25%) was obtained in the cultivar R-72 under T_6. Thereafter, a similar trend was noted upto end of storage (150 days) in guava nectar.

4.3 Organoleptic evaluation of guava nectar during storage

Organoleptic evaluation of guava nectar prepared from four cultivars with different recipes and stored under ambient temperature was done at 30 day interval by a panel of five judges. The scores are presented in Table 4.9 and depicted in Fig. 4.8.

It is apparent from the score data that organoleptic evaluation in guava nectar showed a decreasing trend with all the cultivar and recipe treatments at increasing period of storage (0 to 150 days). The nectar prepared from the cultivar L-49 was scored significantly higher (24.28) followed by Allahabad Safeda (23.28),Apple Colour (21.37) and R-72 (19.92) at the time of preparation. Thereafter, a similar trend was observed upto 150 day of storage. It was also observed that nectar of cultivars L-49 and Allahabad Safeda were highly acceptable upto 150 day of storage period.

Among various recipe treatments, the nectar prepared with T_3 (20% pulp, 0.3% acidity and 17% TSS) had the highest score (25.87) as compared to T_2 (20% pulp, 0.3% acidity and 16% TSS), when evaluated just after

preparation. This trend was also observed throughout the storage period. Further, it was observed that nectar prepared under T_5 (20% pulp, 0.3% acidity and 19% TSS) and T_6 (20% pulp, 0.3% acidity and 20% TSS) had minimum organoleptic score 15.23 and 13.87, respectively at 150 day of storage and therefore the nectar remained unacceptable. However, nectar having recipe T_5 and T_6 was found to be acceptable upto 120 and 90 days, respectively.

However, interaction effect between cultivar and recipe with respect to organoleptic evaluation of guava nectar showed a decreasing trend with increasing period of storage (0 to 150 day). The guava nectar prepared from cultivar L-49 was found to be superior followed by Allahabad Safeda,Apple Colour and R-72 with recipe T_3 (20% pulp, 0.3% acidity and 17% TSS) as compared to the other recipes at the time of preparation. Almost same trend was observed upto 150 day of storage and cultivar L-49 showed significantly a higher organoleptic score (23.44) at 150 day with the recipe having 20 per cent pulp, 0.3 per cent acidity and 17 per cent TSS than rest of the treatments.

4.4 Biochemical changes in guava RTS during storage

4.4.1 Ascorbic acid

Data with respect to ascorbic acid as affected by different recipe and cultivars under storage condition of guava RTS are presented in Table 4.10 and illustrated in Fig.4.9.

It is apparent from the data that ascorbic acid content in guava RTS showed a decreasing trend with all the cultivars and recipe treatments at increasing period of storage (0 to 150 day). The ascorbic acid content was found to be highly significant between cultivars from 0 to 150 day of storage.

The acid content was observed significantly higher in the cultivar L-49 (7.13 mg/100 ml) followed by Allahabad Safeda (5.23 mg/100 ml), Apple Colour (4.08 mg/100 ml) and R-72 (3.31 mg/100 ml) at the time of RTS preparation. Almost similar trend was observed upto 150 days. At the end of 150 day of storage, guava RTS of cultivar L-49 contained maximum ascorbic acid (5.65 mg /100 ml), which was significantly higher than Allahabad Safeda (3.71 mg/100 ml), Apple Colour (2.97 mg/100 ml) and R-72 (2.84 mg/100 ml).

As far as recipe treatments are concerned, the ascorbic acid content was found to be significantly higher (6.44 mg/100 ml) in the RTS prepared with 10 per cent pulp, 0.3 per cent acidity and 12 per cent TSS (T_3) than rest of the recipe treatments, but minimum content (3.65 mg/100 ml) was recorded at the time of preparation (0 day) with 10 per cent pulp, 0.3 per cent acidity and 15 per cent TSS (T_6). Almost same trend of ascorbic acid was observed during storage upto 150 day. At the end of 150 day of storage, RTS with 10 per cent pulp, 0.3 per cent acidity and 12 per cent TSS (T_3) maintained a higher status of ascorbic acid (4.89 mg/100 ml). While, minimum level (2.84 mg/100 ml) was recorded with the recipe having 10 per cent pulp, 0.3 per cent acidity and 15 per cent TSS (T_6).

The combined effect of treatments showed a decreasing trend of ascorbic acid in guava RTS from the time of preparation (0 day) to 150 day of storage. A significantly higher content of ascorbic acid (9.75 mg/100 ml) was observed in the cultivar L-49 with the recipe treatment having 10 per cent pulp, 0.3 per cent acidity and 12 per cent TSS (T_3) at the time of preparation. While, minimum ascorbic acid (2.72 mg/100 ml) was noted in the cultivar R-72 with

the recipe T_5 (10% pulp, 3% acidity and 14% TSS) at the time of preparation. A similar trend was observed upto 150 day of storage. The maximum content of ascorbic acid (8.37 mg/100 ml) was found in the cultivar L-49 with the recipe T_3 (10% pulp, 0.3% acidity and 12% TSS) at 150 day of storage. While, minimum ascorbic acid (2.00 mg/100 ml) was determined in the cultivar R-72 having recipe under T_1 (10% pulp, 0.3% acidity and 10% TSS) at 150 day of storage.

4.4.2 Acidity

Data pertaining to effect of various recipes on the acidity of stored guava RTS of four cultivars at ambient temperature are presented in Table 4.11 and depicted in Fig. 4.10.

It is clear from the data that acidity of stored guava nectar increased throughout the storage period due to recipe treatments and cultivars. However, the acidity was not influenced significantly at the time of preparation (0 day) with the recipe as well as cultivars. Thereafter, at 30 day of storage, the level of acidity increased and was found to be significantly higher in the cultivar R-72 (0.45%) followed by Apple Colour (0.40%), Allahabad Safeda (0.36%) and L-49 (0.33%). Subsequently, almost same trend was observed upto 150 days. At the end of 150 day of storage, guava RTS of cultivar R-72 contained maximum acidity (0.94%), which was significantly higher than Apple Colour (0.86%), Allahabad Safeda (0.76%) and L-49 (0.68%).

Further, it was also observed due to effect of recipe treatments that there was an increasing trend of acidity in guava RTS throughout the storage period (0 to 150 day). The recipe with 10 per cent pulp, 0.3 per cent acidity and 15 per

cent TSS (T_6) in the RTS recorded significantly maximum acidity from 30 day to 150 day of storage, while, minimum acidity was estimated with the recipe (T_3) having 10 per cent pulp, 0.3 per cent acidity and 12 per cent TSS at the same period of storage.

However, interaction effect between cultivars and recipe treatments with respect to acidity in guava RTS showed an increasing trend from the time of preparation (0 day) to 150 day of storage. The acidity was not influenced significantly at the time of preparation (0 day), but it was found to be increased significantly at 30 day of storage in the cultivar R-72 (0.62%) under the T_6 (10% pulp, 0.3% acidity and 15% TSS) than the other recipe treatments. While, minimum acidity was observed in the cultivar L-49 (0.32%) at 30 day of storage and the differences were at par except the recipe T_5 (10% pulp, 0.3% acidity and 14% TSS). Thereafter, almost similar trend was observed upto 150 day of storage and the cultivar R-72 showed a higher acidity (0.99%) at 150 day with the recipe treatments T_5 and T_6 than the rest of the treatments. While, minimum acidity was recorded in the cultivar L-49 (0.49%) under T_3 (10% pulp, 0.3% acidity and 12% TSS) as compared to other recipe treatments.

4.4.3 pH

The effect of various recipes on the pH of guava RTS prepared from four cultivars and stored at ambient temperature for 150 days was ascertained and the data are presented in Table 4.12 and illustrated in Fig. 4.11.

It is obvious from the data that the pH values in guava RTS showed a decreasing trend with all the cultivars at increasing period of storage (0 to 150 day). The pH values were found to be highly significant between cultivars from

the time of preparation (0 day) to 150 day of storage. The pH value was observed significantly higher in the cultivar L-49 (4.58) followed by Allahabad Safeda (3.85), Apple Colour (3.50) and R-72 (3.23) at the time of RTS preparation. Thereafter, same trend was observed upto 150 days. At 150 day of storage, guava RTS of cultivar L-49 contained maximum pH (3.42), which was significantly higher than Allahabad Safeda (2.99), Apple Colour (2.61) and R-72 (2.49).

Due to effect of recipe, the pH value was found to be significantly higher (4.37) in guava RTS prepared with the recipe having 10 per cent pulp, 0.3 per cent acidity and 12 per cent TSS (T_3), than the other treatments, but minimum value (3.43) was recorded at the time of preparation (0 day) with T_6 having recipe 10 per cent pulp, 0.3 per cent acidity and 15 per cent TSS. Almost similar trend of pH was observed during storage upto 150 days. At the end of 150 day of storage, guava RTS prepared with 10 per cent pulp, 0.3 per cent acidity and 12 per cent TSS (T_3) maintained highest pH (3.48), while, minimum pH value (2.58) was recorded under the recipe T_6 having 10 per cent pulp, 0.3 per cent acidity and 15 per cent TSS.

The combined effects of recipe and cultivars also showed a decreasing trend in the pH of RTS from the time of preparation (0 day) to 150 day of storage. A significantly higher value of pH (5.74) was observed in the cultivar L-49 with the recipe T_3 having 10 per cent pulp, 0.3 per cent acidity and 12 per cent TSS, while minimum pH (3.15) was noted in the cultivar R-72 with T_1 (10% pulp, 0.3% acidity and 10% TSS) at the time of preparation. Almost same trend was recorded upto 150 day of storage. The maximum pH (4.87) was

estimated in the cultivar L-49 with T_3 (10%pulp 0.3% acidity and 12% TSS) at 150 day of storage but minimum value was observed in the cultivar R-72 (2.41) with T_6 (10% pulp, 0.3% acidity and 15% TSS).

4.4.4 Total Soluble Solids

The data pertaining to effect of various recipes and cultivars on the total soluble solids of guava RTS stored at ambient temperature was recorded and presented in Table 4.13 and depicted in Fig. 4.12.

It is evident from the data that total soluble solids in guava RTS showed an increasing trend under all the recipe treatments and cultivars with increasing period of storage (0 to 150 day). The TSS content was found to be highly significant between cultivars from 30 to 150 day of storage. The difference in TSS content recorded at the time of preparation was non-significant between cultivars. But at 30 day of storage, the TSS was found to be significantly higher in the cultivar R-72 (12.76%) followed by Apple Colour (12.68%), Allahabad Safeda (12.60%) and L-49 (12.50%). Further, almost similar trend was observed upto 150 days. At the end (150 days) of storage, the RTS of cultivar R-72 contained maximum total soluble solids (13.15%), which was significantly higher than Apple Colour (13.04%), Allahabad Safeda (12.92%) and L-49 (12.77%).

Among the recipe treatments, the TSS was found to be increased from the time of preparation to 150 day of storage in the RTS prepared with various recipes. Similarly, a significantly higher (15.02%) content of TSS was observed with the recipe T_6 (10% pulp, 0.3% acidity and 15% TSS), while minimum TSS (10.04%) was recorded in T_1 (10% pulp 0.3% acidity and 10% TSS) at the

time of preparation. Almost same trend was observed upto 150 days of storage. At 150 day of storage, guava RTS recorded significantly a higher (15.58%) TSS in with T_6 (10% pulp, 0.3% acidity and 15% TSS). While, minimum (10.43%) content of TSS was observed under T_1 (10% pulp, 0.3% acidity and 10% TSS) at 150 day of storage.

Similarly, combined effect between recipe and cultivars with respect to TSS in guava RTS showed an increasing trend with increasing period of storage (0 to 150 day). While, the TSS was not influenced significantly at the time of preparation due to interaction of recipe treatments and cultivars. But, it increased significantly at 30 day of storage and was found to be higher (15.30%) in the cultivar R-72 under T_6 (10% pulp, 0.3% acidity and 15% TSS) as compared to other recipe treatments. While, minimum (10.06%) TSS was noted in the cultivar L-49 under the recipe T_1 (10% pulp, 0.3% acidity and 10% TSS). Almost similar trend was observed upto 150 day of storage. At 150 day of storage, guava RTS recorded significantly higher (15.78%) TSS content in the cultivar R-72 at T_6 (10% pulp, 0.3% acidity and 15% TSS). While, minimum (10.25%) TSS was assessed in the cultivar L-49 under the recipe treatment T_1 (10% pulp, 0.3% acidity and 10% TSS).

4.4.5 Reducing Sugar

The reducing sugar content of guava RTS prepared from various cultivars with different recipes and stored at ambient condition was recorded and the data are presented in Table 4.14 and illustrated in Fig. 4.13.

It is evident from the data that reducing sugar content in guava RTS showed an increasing trend with all the cultivars and recipe treatments at increasing period of storage (0 to 150 day). The reducing sugar was found to be significantly higher between cultivars at the time of preparation (0 day) till 150 day of storage. Its content was observed to be higher in the cultivar R-72 (4.38%) followed by Apple Colour (4.17%), Allahabad Safeda (3.89%) and L-49 (3.54%) at the time of RTS preparation. The similar trend was observed upto 150 day of storage. At the end of 150 day of storage, guava RTS of cultivar R-72 contained maximum reducing sugar (8.44%), which was significantly higher than Apple Colour (6.81%), Allahabad Safeda (6.16%) and L-49 (5.24%).

Among recipe treatments, the guava RTS prepared with various recipes increased the level of reducing sugar at the time of preparation to 150 day of storage. Likewise, significantly a higher (6.78%) content of reducing sugar was observed with T_6 (10% pulp, 0.3% acidity and 15% TSS) at the time of preparation. While, minimum (1.44%) value was noted in T_1 (10% pulp 0.3% acidity and 10% TSS) at the initial analysis. Thereafter, a similar trend was observed upto 150 day of storage. At 150 day of storage, guava RTS recorded significantly a higher (9.59%) reducing sugar in T_6 (10% pulp, 0.3% acidity and 15%TSS). While, minimum (4.07%) content of reducing sugar was noted under T_1 (10% pulp, 0.3% acidity and 10% TSS).

The interaction effects between recipe and cultivars also showed an increasing trend of reducing sugar with increasing period of storage (0 to 150 day). It was found to be significantly higher (7.20%) at the time of preparation

in the cultivar R-72 under T_6 (10% pulp, 0.3% acidity and 15% TSS) than the other recipe treatments. While, minimum (0.95%) reducing sugar content was observed in the cultivar L-49 with T_1 (10% pulp, 0.3% acidity and 10% TSS). Further, the same trend was observed upto 150 day of storage. At the end of 150 day of storage, guava RTS had significantly higher (11.57%) reducing sugar in the cultivar R-72 under T_6 (10% pulp, 0.3% acidity and 15% TSS). While, minimum (2.60%) content was noted in the cultivar L-49 with the recipe T_1 (10% pulp, 0.3% acidity and 10% TSS).

4.4.6 Total Sugar

Data with respect to total sugar as influenced due to recipe as well as cultivar under storage condition of guava RTS are presented in Table 4.15 and depicted in Fig. 4.14.

It is evident from the data that total sugar content in guava RTS showed an increasing trend with all the cultivars and recipe treatments at increasing period of storage (0 to 150 day). The total sugar content was found to be highly significant between cultivars from the time of preparation (0 day) to 150 day of storage. Its content was observed to be significantly higher in the cultivar R-72 (11.70%) followed by Apple Colour (11.65%), Allahabad

Safeda (11.60%) and L-49 (11.55%) at the time of RTS preparation. Almost same trend was observed upto 150 day of storage. The RTS of cultivar R-72 contained maximum total sugar (12.03%), which was significantly higher than Apple Colour (11.92%), Allahabad Safeda (11.83%) and L-49 (11.76%) at 150 day of storage.

Similarly, the recipe treatments also influenced the total sugar of guava RTS and it was found to be increased from the time of preparation to 150 day of storage. A higher (14.12%) content of total sugar was observed with T_6 (10% pulp, 0.3% acidity and 15% TSS), while minimum (9.12%) was recorded under T_1 (10% pulp 0.3% acidity and 10% TSS) at the time of preparation. Almost similar trend was observed upto 150 day of storage. At the end (150 day) of storage, guava RTS recorded significantly a higher (14.57%) total sugar in the recipe treatment T_6 (10% pulp, 0.3% acidity and 15% TSS). While, minimum (9.35%) content was noted under T_1 (10% pulp, 0.3% acidity and 10% TSS).

The combined effects of recipe and cultivars with respect to total sugar in guava RTS showed an increasing trend with increasing period of storage (0 to 150 day). While, the total sugar was not influenced significantly at the time of preparation due to interaction of recipe and cultivars. Thereafter, it was found to be increased significantly and a higher level (14.45%) was recorded at 30 day of storage in the cultivar R-72 under T_6 (10% pulp, 0.3% acidity and 15% TSS) than the rest of the recipe treatments. While, minimum (9.05%) total sugar content was found in the cultivar L-49 with T_1 (10% pulp, 0.3% acidity and 10% TSS). Almost same trend was observed upto 150 day of storage. At the end of 150 day of storage, guava RTS recorded significantly a higher (14.77%) total sugar content in the cultivar R-72 with T_6 (10% pulp, 0.3% acidity and 15% TSS). While, minimum (9.23%) content was noted in the cultivar L-49 under T_1 (10% pulp, 0.3% acidity and 10% TSS).

4.4.7 Non-reducing Sugar

Non-reducing sugar content of guava RTS prepared from various cultivars as affected by the various recipes and storage period at room temperature was recorded and the data are presented in Table 4.16 and illustrated in Fig.4.15.

It is apparent from the data that non-reducing sugar in guava RTS showed a decreasing trend with all the cultivar and treatments at increasing period of storage (0 to 150 day). The non-reducing sugar content was found to be highly significant between cultivars from the time of preparation to 150 day of storage. Its level was observed to be higher in the cultivar L-49 (8.02%) followed by Allahabad Safeda (7.70%), Apple Colour (7.51%) and R-72 (7.31) at the time of preparation. Almost same trend was observed upto 150 day of storage. At the end of 150 day of storage, guava RTS of cultivar L-49 contained maximum non-reducing sugar (6.57%), which was significantly higher than Allahabad Safeda (5.66%), Apple Colour (5.04%) and R-72 (3.60%).

It was also observed due to recipe treatments that there was a decreasing trend of non-reducing sugar in the RTS throughout the storage period (0 to 150 day). Its level was significantly higher (7.97%) in the RTS prepared under recipe T_3 (20% pulp, 0.3% acidity and 12% TSS) than the rest of the treatments, but minimum content (7.34%) was recorded at the time of preparation (0 day) with T_6 (10% pulp, 0.3% acidity and 15% TSS). Almost similar trend of non-reducing sugar was observed during storage upto 150 days. At 150 day of storage, the RTS with recipe T_3 (10% pulp, 0.3% acidity and

12% TSS) maintained maximum (5.54%) non-reducing sugar. While, minimum (4.89%) non-reducing sugar was noted under T_6 (10% pulp, 0.3% acidity and 15% TSS).

Similar decreasing trend of non-reducing sugar was observed due to interaction effects of recipe and cultivars in guava RTS from the time of preparation to 150 day of storage. A significantly higher content of non-reducing sugar (8.30%) was noted in the cultivar L-49 with T_3 (10% pulp, 0.3% acidity and 12% TSS) at the time of preparation, whereas the minimum content (7.00%) was obtained in guava RTS of cultivar R-72 with T_6 (10% pulp, 0.3% acidity and 15% TSS). At the end (150 day) of storage, the cultivar L-49 had maximum content of non-reducing sugar (6.85%) with the recipe T_3 (10% pulp, 0.3% acidity and 12% TSS). While, minimum (3.20) level of the sugar fraction was noted in the cultivar R-72 under T_6 (10% pulp, 0.3%acidity and 15%TSS).

4.5 Organoleptic evaluation of guava RTS during storage

Organoleptic evaluation of guava RTS prepared from four cultivars with different recipes and stored under ambient temperature was carried out at 30 day interval by a panel of five judges. The scores are presented in Table 4.17 and depicted in Fig. 4.16.

It is apparent from the score data that organoleptic evaluation in guava RTS exhibited a decreasing trend with all the cultivars and recipes at increasing period of storage (0 to 150 day). The RTS prepared from cultivar L-49 was scored significantly higher (23.74) among all the cultivars at the time of preparation (0 day). The same trend was observed upto 150 day of storage

period. At the end of 150 day of storage, the RTS prepared from cultivar L-49 and Allahabad Safeda were highly acceptable upto 150 day of storage period.

Among various recipe treatments, the guava RTS prepared under T_3 (10% pulp, 0.3% acidity and 12% TSS) showed the highest score (24.90) as compared to T_2 (10% pulp, 0.3% acidity and 11% TSS) and other recipes, when evaluated just after preparation. The same trend was observed throughout the storage period. Further, it was also observed that RTS with T_5 (10% pulp, 0.3% acidity and 14% TSS) and T_6 (10% pulp, 0.3% acidity and 15% TSS) showed minimum organoleptic score 15.41 and 14.17, respectively and hence remained unacceptable at 150 day of storage. However, the RTS having recipe T_5 and T_6 was acceptable upto 120 and 90 days, respectively.

Similarly, the interaction effect between cultivars and recipe treatments with respect to organoleptic evaluation of guava RTS showed a decreasing trend with increasing period of storage (0 to 150 day). The guava RTS prepared from cultivar L-49 was found to be superior followed by Allahabad Safeda, Apple Colour and R-72 with recipe having T_3 (10% pulp, 0.3% acidity and 12% TSS) as compared to the other recipe treatments at the time of preparation. Almost same trend was observed upto 150 day of storage and the cultivar L-49 showed a significantly higher organoleptic score (23.85) followed by Allahabad Safeda (23.15) at 150 day with the recipe treatment T_3 than rest of the treatments.

Table 4.1 : Physico-chemical composition of guava fruits at harvest

S. No.	Characters \ Cultivars	Apple Colour	Allahabad Safeda	L-49	Rewa-72
A.	Physical composition of guava fruit				
1.	Weight of fruit (g)	107.76	112.14	188.71	175.05
2.	Weight of pulp (g)	93.48	94.18	163.34	148.91
3.	Weight of peel (g)	9.40	11.34	15.64	14.31
4.	Weight of non-edible waste (g)	3.08	3.12	4.58	5.24
5.	Weight of seed (g)	3.75	3.88	5.08	6.59
6.	No. of seeds per fruit	476.00	379.00	540.00	667.00
7.	Pulp : seed ratio	25.95	26.31	32.02	22.64
B.	Chemical composition of guava fruit				
1.	Total soluble solids (%)	11.32	13.49	14.53	13.09
2.	Total sugars (%)	9.23	10.24	11.63	10.06
3.	Reducing sugar (%)	4.73	6.46	6.62	6.53
4.	Non-reducing sugar (%)	4.49	3.77	5.05	3.53
5.	Ascorbic acid (mg/100 g)	241.40	332.10	366.50	135.25
6.	Acidity (%)	0.64	0.49	0.76	0.94
7.	pH	4.87	5.52	5.51	4.25

CHAPTER-V

DISCUSSION

The present investigation entitled "Evaluation of guava (*Psidium guajava* L.) varieties for processing into nectar and ready-to-serve beverages" was conducted with four guava varieties and observations on important aspects of processing were recorded. The salient features of these observations have been discussed and interpreted below in the light of available literature.

5.1 Physico-chemical composition of fruits

The physical composition of mature fruits was studied at harvest for fruit weight, pulp weight, peel weight, seed weight, number of seeds per fruit, pulp/seed ratio and weight of non-edible wastes. The data (Table 4.1) showed that weight of fruit, pulp and peel was recorded the highest in the cultivar L-49 followed by R-72, Allahabad Safeda and Apple Colour. The weight of seed and non-edible wastes was maximum in the cultivar R-72 followed by L-49, Allahabad Safeda and Apple Colour. The number of seeds per fruit was found to be more in the cultivar R-72 followed by L-49, Apple Colour and Allahabad Safeda. The cultivar L-49 had maximum pulp/seed ratio followed by Allahabad Safeda, Apple Colour and R-72. The variation in physical characters of fruit was probably due to varietal characteristics having different size and shape of fruits. Almost similar variation in physical composition of fruits were also reported by Ojha *et al.* (1987), Murari and Verma (1989) and Pandey and Singh (1998) in different guava cultivars.

The chemical constituents *viz.*, TSS, total sugar and ascorbic acid analysed in the mature fruits had maximum content in the cultivar L-49 followed by Allahabad Safeda. The cultivar L-49 had maximum reducing sugar followed by R-72. Similarly, the non-reducing sugar was also high in the cultivar L-49 followed by Apple Colour. The acidity was found to be higher in the cultivar R-72 followed by L-49, Apple Colour and Allahabad Safeda. The cultivar Allahabad Safeda had maximum pH followed by L-49, Apple Colour and R-72. The difference in the chemical composition of fruits in guava cultivars may be due to varietal characters governed by a particular gene. The preference of cultivar L-49 and Allahabad Safeda over other varieties was possibly due to their excellent flavour and quality. Almost similar varietal differences in chemical composition of fruits were also reported by Murari and Verma (1989) and Pandey and Singh (1998) in guava cultivars.

5.2 Biochemical changes in guava nectar and RTS during Storage

5.2.1 Ascorbic acid

The ascorbic acid content in guava nectar and RTS showed a decreasing trend with increasing period of storage upto 150 days at ambient condition under all the cultivars and recipe treatments (Table 4.2 & 4.10). The nectar and RTS of cultivar L-49 had significantly higher ascorbic acid followed by Allahabad Safeda, Apple Colour and R-72 at the time of preparation of products. Thereafter, a similar trend was observed upto 150 days of storage. At the end of storage (150 day), the nectar and RTS of cultivar L-49 contained maximum ascorbic acid followed by Allahabad Safeda, Apple Colour and R-72. The nectar

and RTS having the recipe T_3 had significantly higher ascorbic acid at the time of preparation, but minimum content was noted under T_5 and T_6 in nectar and RTS, respectively. Thereafter, a similar trend was observed upto 150 days of storage under ambient condition and the products maintained supremacy by retaining maximum ascorbic acid under the recipe T_3. The combined effects of cultivar and recipe showed similar response to ascorbic acid as observed with individual treatments alone. However, the RTS under recipe T_5 had minimum content of ascorbic acid instead of T_6 in the cultivar R-72.

The decrease in ascorbic acid in nectar and RTS during storage might be due to oxidation or irreversible conversion of L-ascorbic acid into dehydro ascorbic acid in the presence of enzyme ascorbic acid oxidase (ascorbinase) caused by trapped or residual oxygen in the glass bottles. Similar reduction in ascorbic acid content have also been reported in guava beverages (Baramanray *et al.*, 1995; Pandey and Singh, 1998; Pandey, 2004).

5.2.2 Acidity

The acidity in guava nectar and RTS increased with all the cultivar and recipe treatment under ambient condition at increasing period of storage upto 150 days (Table 4.3 & 4.11). However, the acidity was not influenced significantly at the time of preparation due to cultivars and recipe in nectar and RTS. Subsequently, at 30 day of storage, it was found to be increased significantly and the cultivar R-72 contained its higher level followed by Apple Colour, Allahabad Safeda and L-49 in nectar and RTS. Thereafter, the same trend was observed upto 150 days of storage. The nectar and RTS having recipe T_6 had significantly a higher level of

acidity at 30 day of storage, while lowest content was noted under the recipe T_3. Further, the same trend was observed upto 150 day of storage. The interaction of cultivar and recipe showed an increasing trend of acidity in nectar and RTS with increasing period of storage upto 150 days. However, non-significant differences were observed with acidity in guava nectar upto 150 days. The RTS had also a non-significant difference in the acidity at the time of preparation. Further, it increased significantly at 30 day of storage in the cultivar R-72 under the recipe T_6. While, cultivar L-49 had minimum acidity at 30 day of storage, but the differences were non-significant except the recipe T_5. Thereafter, almost similar trend was observed upto 150 day of storage and cultivar R-72 contained higher acidity at 150 day with recipe treatments T_5 and T_6. While, cultivar L-49 had minimum acidity under T_3 at 150 day of storage.

The increase in acidity in nectar and RTS during 150 day of storage may be due to formation of organic acids by ascorbic acid degradation as well as progressive decrease in the pectin content. Similar findings were also reported in the beverages of papaya (Kumar, 1990), mango (Rabbani, 1992) and guava (Baramanray *et al.,* 1995 ; Pandey and Singh, 1998 ; Pandey 2004).

5.2.3 pH

The pH value in guava nectar and RTS showed a decreasing trend with all the cultivar and recipe treatments at increasing period of storage upto 150 day under room temperature (Table 4.4 & 4.12). The cultivar L-49 had significantly a higher pH followed by Allahabad Safeda, Apple Colour and R-72 at the time of preparation in both the guava products. During storage, the cultivar L-49

contained maximum pH at all stages upto 150 days. The nectar and RTS prepared with the recipe T_3 had significantly higher pH at the time of preparation, but minimum value was noted under the recipe T_6. Subsequently, the same trend was observed upto 150 day of storage. Almost similar combined effects were observed between cultivar and recipe treatments in respect to pH of nectar and RTS upto 150 day of storage under ambient condition.

The increased acidity and TSS under all the cultivar and recipe treatments during storage had a corresponding decrease in pH. Hence, the reduction in pH could be attributed to simultaneous increase in acidity and TSS of nectar and RTS irrespective of their storage temperature. The present findings are in agreement with those of Sethi (1993) and Prasad and Mali (2000) in litchi and pomegranate squash, respectively.

5.2.4 Total soluble solids

The TSS content in guava nectar and RTS showed an increasing trend under all the cultivar and recipe treatments with increasing period of storage upto 150 days at ambient condition (Table 4.5 & 4.13). The cultivar R-72 had significantly a higher percentage of TSS followed by Apple Colour, Allahabad Safeda, and L-49 in guava nectar and RTS from 30 day to 150 day of storage. Similarly, the recipe T_6 had a higher content of TSS, while minimum TSS was noted under T_1 in both the processed products from the time of preparation to 150 day of

storage. The combined effect of cultivar and recipe treatments showed a similar response to TSS as observed with individual treatments.

The increased TSS in nectar and RTS during storage was probably due to conversion of left over polysaccharides into soluble sugars. In conformity of this, similar results were reported in date juice RTS (Godara and Pareek, 1985) and guava beverages (Baramanray *et al.*, 1995; Pandey and Singh, 1998 and Pandey, 2004).

5.2.5 Sugars

The reducing sugar content in guava nectar and RTS showed an increasing trend with all the cultivars and recipe treatments at increasing period of storage upto 150 days under ambient condition (Table 4.6 & 4.14). The products of cultivar R-72 contained maximum reducing sugar followed by Apple Colour, Allahabad Safeda and L-49 from the time of preparation (0 day) to 150 day of storage. The treatment having recipe T_6 had a higher content of reducing sugar, while recipe T_1 contained its minimum fraction from the time of preparation (0 day) to 150 day of storage period. The interaction studies showed similar effect on reducing sugar in both the processed products during storage upto 150 days under ambient condition.

There was also an increasing trend of total sugar in guava nectar and RTS with all the cultivar and recipe treatments at increasing period of storage under ambient condition (Table 4.7 & 4.15). The nectar and RTS prepared from the fruits of cultivar R-72 recorded maximum total sugar in the products just after preparation to 150 day of storage, while cultivar L-49 contained minimum level

of total sugar during storage. The recipe T_6 had a higher status of total sugar but its minimum level was recorded under the recipe T_1 from the time of preparation to end of storage (150 days). The combined effects between treatments also showed an increasing trend of total sugar with increasing period of storage. The nectar and RTS prepared from cultivar R-72 contained significantly a higher level of total sugar under T_6 from 60 to 150 day and 30 to 150 day of storage, respectively. While, the cultivar L-49 had minimum content of sugar from 0 to 150 day of storage with the recipe T_1.

The non-reducing sugar in nectar and RTS showed a decreasing trend with all the cultivar and recipe treatments at increasing period of storage (Table 4.8 & 4.16). The sugar content was higher in the cultivar L-49 followed by Allahabad Safeda, Apple Colour and R-72 upto end of storage (150 days) at ambient condition. The non-reducing fraction of sugar was found to be higher in nectar and RTS prepared with the recipe T_3, but its minimum content was noted under T_6 from initial estimation (0 day) to 150 days of storage. The combined effects (cultivar & recipe) also showed similar response to non-reducing sugar in both the products stored at ambient condition upto 150 days.

The increase in reducing sugar as well as total sugar corresponded to the increase in total soluble solids (TSS) and ultimate decrease in non-reducing sugar in both the beverages during storage period. The variation in different fractions of sugar might be due to hydrolysis of polysaccharides like starch, pectin and inversion of non-reducing sugar into reducing sugar, as increase in reducing sugar was correlated with the decrease in non-reducing sugar. The increased level of total

sugar was probably due to conversion of starch and pectin into simple sugars. Similar findings were reported by Murari and Verma (1989) and Baramanray *et al.* (1995) in guava nectar and by Shrivastava (1998) in mango beverages.

5.2.6 Organoleptic evaluation (Nectar and RTS)

The organoleptic score decreased with all the cultivar and recipe treatments at increasing period of storage (Table 4.9 & 4.17). The nectar and RTS prepared from cultivar L-49 had a higher score followed by Allahabad Safeda at the time of preparation and the products of both the cultivars were highly acceptable upto 150 day of storage. The nectar and RTS prepared with the recipe T_3 had highest organoleptic score followed by T_2 and T_1 upto 150 days of storage. However, the nectar and RTS with recipe T_5 and T_6 was acceptable upto 120 and 90 days, respectively during storage at ambient condition. The combined effects of cultivar and recipe also showed similar response to organoleptic score for both the processed products upto 150 days of storage. The nectar and RTS had a gradual decrease in organoleptic quality during storage period at ambient condition.

There was a considerable decrease in sensory mean score for taste, flavour and overall acceptability during storage. The sensory mean score for each attribute was highest on the day of preparation, which decreased with increasing period of storage. There are many extrinsic factors which determines the storage stability of products and temperature plays an important role among them. There are certain biochemical changes which occurs under low pH and high temperature

that leads to formation of brown pigment and produces off flavour in the beverages.

The other possible reasons could be the loss of volatile aromatic substances responsible for flavour and taste which decreased acceptability in storage at ambient condition. The present findings are in accordance with the view of Baramanray *et al.* (1995) in guava nectar and Thakur and Barwal (1998) in *kiwi* fruit squash.

CHAPTER-VI

SUMMARY, CONCLUSION AND SUGGESTIONS FOR FUTURE WORK

The present investigation entitled "Evaluation of guava (*Psidium guajava* L.) varieties for processing into nectar and ready-to-serve beverages" was carried out in the Department of Horticulture, College of Agriculture, Indira Gandhi Agricultural University, Raipur (C.G.) during the year 2003-04. The investigation was undertaken with a view to assess the quality and shelf life of guava nectar and RTS beverages during storage upto 150 days under ambient condition.

The experimental material consisted of four cultivars of guava i.e., Apple Colour, Allahabad Safeda, L-49 and R-72 and six recipes each for nectar (pulp 20% & acidity 0.3%) and RTS (pulp 10% & acidity 0.3). The different recipes were maintained with varying levels of TSS for nectar (15-20%) and RTS (10-15%). Thus, the treatment combinations were twenty four and replicated thrice under Completely Randomized Design (with factorial arrangement).

The fresh guava fruits from four cultivars were harvested at full maturity (colour break stage) and analysed for physico-chemical characters. During storage, the nectar and RTS were also analysed periodically at 30 day interval for their various chemical constituents. The results of experiment obtained during studies pertaining to various physico-chemical constituents are summarized as follows:

The fresh fruits of cultivar L-49 had highest weight of fruit, pulp and peel followed by R-72, Allahabad Safeda and Apple Colour. The weight of seed and non-edible waste was maximum in the cultivar R-72 followed by L-49, Allahabad Safeda and Apple Colour. The number of seeds per fruit was also highest in the cultivar R-72 followed by L-49, Apple Colour and Allahabad Safeda. The cultivar L-49 had maximum pulp/seed ratio followed by Allahabad Safeda, Apple Colour and R-72.

The mature fruits of cultivar L-49 had maximum TSS, total sugar and ascorbic acid content followed by Allahabad Safeda. The cultivar L-49 contained maximum reducing sugar followed by R-72. The non-reducing sugar was also high in the cultivar L-49 followed by Apple Colour. The cultivar R-72 had highest acidity followed by L-49, Apple Colour and Allahabad Safeda. The pH was high in the cultivar Allahabad Safeda followed by L-49, Apple Colour and R-72.

After processing, the ascorbic acid content in guava nectar and RTS decreased with increase in storage period upto 150 days at ambient condition. The cultivar L-49 had highest level of ascorbic acid followed by Allahabad Safeda, Apple Colour and R-72 in both the processed products during storage. The maximum ascorbic acid was retained in the nectar having recipe 20 per cent pulp, 0.3 per cent acidity and 17 per cent TSS (T_3) and in RTS with the recipe 10 per cent pulp, 0.3 per cent acidity and 12 per cent TSS (T_3). The level of ascorbic acid was found to be minimum in nectar and RTS under the recipe T_5 (20% pulp 0.3%

acidity and 19% TSS) and T_6 (10% pulp, 0.3% acidity and 15% TSS), respectively.

The acidity in guava nectar and RTS increased with all the cultivar and recipe treatments at increasing period of storage upto 150 day under ambient condition. The acidity was found to be highest in nectar and RTS prepared from the cultivar R-72, but the cultivar L-49 had its minimum content during storage period. Similarly, both the beverages had maximum acidity having recipe 20 per cent pulp, 0.3 per cent acidity and 20 per cent TSS (T_6) for nectar and 10 per cent pulp, 0.3 per cent acidity and 15 per cent TSS (T_6) for RTS. While, the recipe treatment T_3 for nectar (20% pulp, 0.3% acidity and 17% TSS) and RTS (10% pulp, 0.3% acidity and 12% TSS) had minimum acidity during storage.

A gradual decline in the pH of nectar and RTS was recorded throughout the storage period upto 150 days at ambient condition. The pH value was highest in the processed products of cultivar L-49 followed by Allahabad Safeda, Apple Colour and R-72 during storage. Likewise, the maximum pH was found with the recipe T_3 for nectar (20% pulp, 0.3% acidity and 17% TSS) and RTS (10% pulp, 0.3% acidity and 12% TSS) during storage. Whereas, the minimum pH was noted with the recipe T_6 in nectar (20% pulp, 0.3% acidity and 20% TSS) and RTS (10% pulp, 0.3% acidity and 15% TSS) during storage.

The TSS increased gradually in the nectar and RTS during storage period upto 150 days at ambient condition. The maximum TSS content was noted in nectar and RTS prepared from the cultivar R-72. While, the products of the cultivar L-49 had minimum TSS during storage (0 to 150 day). Similarly, a higher TSS

content was recorded in nectar and RTS prepared from the recipe T_6 by maintaining the TSS 20 and 15 per cent, respectively as compared to other recipe treatments during storage period upto 150 days under ambient condition.

The reducing sugar content in guava nectar and RTS also showed an increasing trend with all the cultivars and recipe treatments at the increasing period of storage upto 150 days under ambient condition. The beverages (nectar and RTS) of cultivar R-72 contained maximum reducing sugar followed by Apple Colour, Allahabad Safeda and L-49 during storage. Similarly, treatment having recipe T_6 had a higher content of reducing sugar in nectar and RTS, while the recipe T_1 contained its minimum level during storage upto 150 days.

There was also an increasing trend of total sugar in guava nectar and RTS with all the cultivar and recipe treatments at increasing period of storage under ambient condition. The processed products of cultivar R-72 had maximum total sugar, while cultivar L-49 contained minimum total sugar during storage. The recipe T_6 for nectar (20% pulp, 0.3% acidity and 20% TSS) and RTS (10% pulp, 0.3% acidity and 15% TSS) had a higher status of total sugar, but its minimum level was recorded in nectar and RTS under the recipe T_1 having TSS 15 and 10 per cent, respectively during storage upto 150 days.

A progressive decrease in non-reducing sugar was noted throughout the storage period upto 150 days at ambient condition. The nectar and RTS prepared from the cultivar L-49 had highest non-reducing sugar, but lowest in the cultivar R-72 during storage upto 150 days. The non-reducing sugar content was higher in the nectar and RTS prepared with the recipe T_3 having TSS 17 and 12 per cent,

respectively. But, the minimum content was noted under the recipe T_6 from the time of preparation to 150 day of storage.

The organoleptic score decreased with all the cultivar and recipe treatments at increasing period of storage upto 150 days at ambient condition. The nectar and RTS prepared from cultivar L-49 had a higher score followed by Allahabad Safeda and the products of both the cultivars were highly acceptable upto 150 days. The nectar and RTS prepared with the recipe T_3 had highest organoleptic score followed by T_2 and T_1 upto 150 days of storage. However, the beverages with recipe T_5 and T_6 were also acceptable upto 120 and 90 days, respectively during storage.

Conclusion

1. The guava fruits of cultivar L-49 had highest weight of fruit, pulp and peel as well as high pulp/ seed ratio. The another cultivar Allahabad Safeda had less seed and non-edible wastes. Hence, these two cultivars may be considered better on the basis of physico-chemical composition of fruits.
2. The fruits of cultivar L-49 had highest content of TSS, total sugar and ascorbic acid followed by Allahabad Safeda. The reducing and non-reducing sugar was also high in cultivar L-49. The fruit of cv. Allahabad Safeda had a high pH as compared to L-49. In view of these facts, both the cultivars may be selected for preparation of guava beverages.
3. The nectar and RTS prepared from the cultivar L-49 and Allahabad Safeda recorded highest organoleptic score and hence best suited for commercial scale.

4. The recipe having 20 per cent pulp, 0.3 per cent acidity and 17 per cent TSS was found to be superior for nectar preparation in respect to commercial scale.

5. The RTS prepared from the recipe 10 per cent pulp, 0.3 per cent acidity and 12 per cent TSS was found to be suitable for commercial scale.

6. The nectar and RTS prepared from the cultivar L-49 had highest ascorbic acid, pH, non-reducing sugar and organoleptic score as compared to Allahabad Safeda during storage upto 150 days under ambient condition. Hence, these two cultivars can be utilized for the preparation of nectar and RTS.

7. The nectar prepared from the recipe 20 per cent pulp, 0.3 per cent acidity and 17 per cent TSS contained highest ascorbic acid, pH, non-reducing sugar and organoleptic score as compared to other recipes during storage. Therefore, the nectar may be prepared from the above standardized recipe.

8. The RTS prepared from the recipe T3 (10% pulp, 0.3% acidity and 12% TSS) had highest ascorbic acid, pH, non-reducing sugar and organoleptic score than other recipe treatments during storage upto 150 days under ambient condition. Hence, the standardized recipe may be used for RTS preparation.

Suggestions for future work

1. The present experiment is based on the results of one year study. Hence, it should be repeated for one year more to find out conformity of the results so

that definite recommendations could be made for an ideal guava nectar and RTS preparation.

2. The recipes standardized for nectar and RTS can be exploited for commercial use after concrete recommendations.
3. Research work should be intensified for the processing of beverage based on locally available raw material as well as guava fruits.
4. A little attention has been made so far in the field of fruit processing technology in Chhattisgarh region. Hence, there is an urgent need to standardize the various recipes for different preserved products of guava.

Evaluation of guava (*Psidium guajava* L.) varieties for processing into nectar and ready-to-serve beverages

by

Madan Lal Choudhary

ABSTRACT

The present study was carried out in the Department of Horticulture, College of Agriculture, IGAU, Raipur (C.G.) during 2003-04. The experimental material consisted of four cultivar of guava and six recipes maintained for nectar and RTS with varying levels of TSS. The treatment combinations were 24 and replicated thrice under completely randomized design with factorial arrangement.

The fruits of four guava cultivars were analysed for physico-chemical characters at full maturity. The nectar and RTS prepared from different cultivar and recipes were also analysed periodically at 30 day interval for their various chemical constituents. The fresh fruits of cv. L-49 recorded highest weight of fruit, pulp, peel, pulp/seed ratio, TSS, total sugar, ascorbic acid, reducing and non-reducing sugar. The cultivar R-72 had maximum weight of seed and non-edible wastes followed by L-49, Allahabad Safeda and Apple Colour. The highest acidity was observed in the cultivar R-72, while minimum content in Allahabad Safeda. The cultivar Allahabad Safeda recorded high pH followed by L-49, Apple Colour and R-72.

The beverage prepared from the cultivar L-49 had highest content of ascorbic acid, pH, non-reducing sugar and also scored highest organoleptic value. Among various recipe tried in this investigation, the nectar prepared from 20 per cent pulp, 0.3 per cent acidity and 17 per cent TSS recorded highest organoleptic score. Similarly, preparation of RTS with 10 per cent pulp, 0.3 per cent acidity and 12 per cent TSS scored higher organoleptic value. During storage of nectar and RTS, the acidity, TSS, total and reducing sugar showed an increasing trend with increasing period of storage (0 to 150 day) under ambient condition. While, there was a decreasing trend of ascorbic acid, pH, non-reducing sugar and organoleptic score during storage period upto 150 days of storage under ambient condition.

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BIBLIOGRAPHY

Anonymous, 2004. State vision document for Chhattisgarh project proposal for National Horticulture Mission, Directorate of Agriculture.

Attri, B.L. and Singh, D.B. 2003. Post-harvest changes in guava during storage. *Indian Hort.*, 47 (4) : 24-25.

Awasthi, R.K. and Pandey I.C. 1980. Physico-chemical composition and canning suitability of mango varieties. *Indian Fd Pack.*, 34 (3) : 60.

Baramanray, A., Gupta, O.P. and Dhawan, S.S. 1995. Evaluation of guava (*Psidium guajava* L.) hybrids for making nectar. *Haryana J. Hort. Sci.*, 24 (2) : 102-109.

Barwal, V.S. and Kalia, M. 1998. Studies on quality attributes and preservation techniques of Kinnow juice. *Haryana J. Hort. Sci.*, 27 (1) : 1-4.

Bons, H.K. and Dhawan, S.S. 2003a. Effect of preserved guava pulp on the quality of ready-to-serve beverage. *Crop Res.*, 25 (2) : 360-363.

Bons, H.K. and Dhawan, S.S. 2003b. Evaluation of methods for preparation of guava juice concentrate. *Crop Res.*, 25 (2) : 364-368.

*Brekke, J.E., Cavaletto, C.G., Nakayama, T.O.M. and Suehisa, R.H. 1976. Effect of storage temperature and container lining on some quality attributes of papaya nectar. *J. Agri. Fd Chem.*, 24 (2) : 341-343.

Chadha, K.L. 2002. Handbook of Horticulture (ed.), ICAR, New Delhi, 4 p.

Chundawat, B.S., Singh, H.K. and Gupta, O.P. 1978. Effect of different methods of ripening in guava (*Psidium guajava* L.) on quality of fruits. *Haryana J. Hort. Sci.*, 7 (1-2) : 28-30.

Chundawat, B.S., Singh, H.K., Singh, B.P. and Gupta, O.P. 1978. Shelf life of guava (*Psidium guajava* L.) fruits as influenced by maturity. *Haryana. J. Hort. Sci.*, 7 (3 & 4) : 148-151.

Chundawat, B.S., Singh, J.P., Kaisna, R.L. and Gupta, O.P. 1976. Post-harvest studies on guava fruit : Effect of packaging and storage period on the quality of fruit. *Haryana J. Hort. Sci.*, 5 (3&4) : 130-136.

Dwivedi, A.K. and Mitra, S.K. 2000. Performance of litchi (*Litchi chinensis* sonn.) cultivars for processing into squash. *Haryana J. Hort. Sci.*, 29 (3 & 4) : 176-177.

Ghosh, H.G., Nirmala, M., Krishnappa, K.G., Parameshwariah, P.H., Borkar, H. and Vijayaraghavan, P.K. 1982. Preservation of fruit juices and pulp in flexible pouches. *Indian Fd Pack.*, 36 (4) : 23-26.

Godara, R.K. and Pareek, O.P. 1985. Effect of temperature on storage life of ready-to-serve date juice beverage. *Indian J. agri. Sci.*, 55 (5) : 347-349.

Grewal, K.S. and Jain, S.C. 1982. Studies on the feasibility of incorporating preserved mango pulp in the preparation of Milk mango powder. *Indian Fd Pack.*, 36 (4) : 95.

Harnanan, S.W., Bains, G.C. and Kripal, K. 1980. Studies on processing of pink and white fleshed guava varieties for pulp. *Punjab Hort. J.*, 20 : 179.

Jain, M.L. and Broker, D.H. 1970. Preservation and storage stability of ready-to-serve beverage from guava (*Psidium guajava* L.). *Indian Fd Pack.*, 24 : 29.

Jain, V., Tiwary, B.L., Sharma, H.G. and Saxena, R.R. 1996. Evaluation of late maturing mango varieties for the preparation of beverages as nectar and RTS. *Indian Fd Pack.*, 50 (3) : 9-14.

Kalra, S.K. and Revethi, G. 1981. Storage studies on guava (*Psidium guajava* L.) pulp. *Indian Fd Pack.*, 35 (6) : 29.

Kalsi, H. and Dhawan, S.S. 2001. Studies on the preparation and storage of guava bar. *Haryana J. Hort. Sci.*, 30 (3 & 4) : 187-189.

Kalsi, H., Dhawan, S.S. and Singh, R. 2002. Studies on the extraction and concentration of guava juice. *Crop Res.*, 24 (1) : 184-187.

*Kerure, Y.E. and Kjedkar, D.M. 1982. Studies on ready-to-serve beverages. *International Food Abstract of Technical Papers.* 7 : 1.

Khurdiya, D.S. 1980. A new beverages from dried *ber* (*Zizyphus mauritiana* Lamk.). *J. Fd. Sci. Technol.*, 17 : 158.

Khurdiya, D.S. and Anand, J.C. 1981. Effect of storage temperatures on the quality of *phalsa* beverage. *J. Fd. Sci. and Technol.*, 18 : 160-161.

Khurdiya, D.S. and Roy, S.K. 1984. Anthocyanin a quality index in *Jamun* beverages. *Indian Fd Pack.*, 38 (6) : 71-76.

Kotecha, P.M., Adsule, R.N. and Kadam, S.S. 1995. Processing of custard apple : Preparation of ready-to-serve beverage and wine. *Indian Fd Pack.*, 49 : 5-11.

*Kumar, S. 1990. Studies on post-harvest technology of papaya fruits. Ph.D. Thesis, NDUA & T, Kumarganj, Faizabad. (U.P.)

Mehta, G.L. and Tomar, M.C. 1980. Studies on dehydration of tropical fruits in Uttar Pradesh. II. Guava (*Psidium guajava* L.). *Indian Fd Pack.*, 34 (4) : 8.

Mehta, U. and Rathore, H. 1976. Storage studies on preserved juice from amla. *Indian Fd Pack.*, 30 (1) : 9.

Mitra, S.K. and Bose, T.K. 1985. Guava. *In* : Fruits : Tropical and Subtropical (ed. T.K.Bose), Naya Prokash, Calcutta, : 277-297pp.

Murari, K. and Verma, R.A. 1989. Studies on the effect of varieties and pulp extraction methods on the quality of guava nectar. *Indian Fd. Pack.*, 42 (5) : 11-15.

*Negy, S. and Shaw, P.E. 1980. Tropical and subtropical fruits. AVI publishing Company Inc., Westport, Connecticut. 279 p

Ojha, A.P., Tiwari, J.P. and Mishra, K.K. 1987. A note on seasonal variations in the physico-chemical composition of guava (*Psidium guajava* L.) cultivars Sardar and Allahabad Safeda under tarai conditions of U.P. *Haryana J. Hort. Sci.,* 16 (1-2) : 90-91.

Pandey, A.K. 2004. Study about the storage stability of guava beverages. *Prog. Hort.*, 36 (1) : 142-145.

Pandey, A.K. and Singh, I.S. 1998. Studies on preparation and preservation of guava squash. *Prog. Hort.*, 30 (3-4) : 190-193.

Panse, V.G. and Sukhatme, P.V. 1985. Statistical methods for Agricultural workers, IV Ed., ICAR, New Delhi.

*Pilnik, W. and Vorange, A.G. J. 1989. Effect of enzyme treatment on the quality of processed fruit and vegetables. *ACS Symposium Series,* 405 : 250-269.

Prasad, R.N. and Mali, P.C. 2000. Changes in physico-chemical characteristic of pomegranate squash during storage. *Indian J. Hort.*, 57 (1) : 18-20.

*Rabbani, A. 1992. Studies of post-harvest technology of sucking mangoes. Ph.D. Thesis, NDUA & T, Kumarganj, Faizabad, (U.P.).

Rabbani, A. and Singh, I.S. 1988. Evaluation of local sucking mango varieties for beverage industry. *Acta Hort.*, 231 : 715-720.

Rajput, C.B.S., Singh, S.N. and Singh, N.P. 1977. Effect of certain plant growth substance in guava (*Psidium guajava* L.). *Haryana J. Hort. Sci.*, 6 (3 & 4) : 117.

Ranganna, S. 1997. Hand book of analysis and quality control for fruit and vegetable products. Tata McGraw Hill Publishing Co. Ltd., New Delhi.

Ranote, P.S. and Bains, G.S. (1982). Juice of Kinnow fruit. *Indian Fd Pack.*, 36 (5) : 23.

Roy, S.K. and Singh, R.N. 1979. Studies on utilization of *bael* fruit (*Aegle marmelos* Correa) products. *Indian Fd Pack.*, 33 : 9-14.

Roy, S.K., Singh, R.N. and Singh, R. 1972. Studies on evaluation of some mango varieties of North India for processing as nectars. *Indian Fd Pack.*, 26 (5) : 5-8.

*Sachan, B.P., Pandey, D. and Shankar, G. 1969. Influence of weather on the chemical composition of guava (*Psidium guajava* L.) fruits var. Allahabad Safeda. *Punjab Hort. J.*, 9 (3 & 4) : 119.

Sahni, C.K. and Khurdiya, D.S. 1989. Effect of ripening and storage temperature on the quality of mango nectar. *Indian Fd Pack.*, 43 (6) : 5-11.

Sarmah, U.G., Bains, S. and Singh, K.K. 1981. Studies on the processing of Kinnow mandarin juice. *Punjab Hort. J.*, 21 : 32.

Sethi, V. 1993. Changes in physico-chemical characteristics of litchi squash during storage at different temperature. *Indian J. Hort.*, 50 (4) : 327-332.

Sethi, V. and Anand, J.C. 1982. Physico-chemical and microbiological quality of carrot and amla preserve. *Indian Fd Pack.* 36 (5) : 38.

Sethi, V. and Anand, J.C. 1983. Prepare litchi squash at home. *Indian Hort.*, 28 (1) : 27.

Sethi, V., Anand, J.C. and Saxena, S.K. 1980. Kinnow orange in juice and beverage making. *Indian Hort.*, 25 (3) : 13.

*Shetty, M.S., Malathi, H.N., Nayandawamy, A.M. and Polly, V.H. 1978. Mango an industrial profile. Bull. C.F.T.R.I., Mysore.

Shrestha, M.K. and Bhatia, B.S. 1982. Apple juice physico-chemical characteristics and storage study. *Indian Fd Pack.*,36 (3) : 53.

Shrivastava, J.S. 1998. Comparative study of RTS drinks prepared from Dashehari and Banganpalli mangoes. *Indian Fd Pack.*, 52(2) : 38-42.

*Singh, Gorakh, Rajan, S. and Pandey, D. 1993. Profits from guava. *Intensive Agri.*, 31 (3-4) : 35.

Singh, I.S. and Dhawan, S.S. 1983. Potentiality of various fruits for processing industry. *Indian Fd Pack.*, 37 : 47-53.

Singh, N.P. and Rajput, C.B.S. 1977. Chemical composition of guava fruit as influenced by nitrogen applications. *Prog. Hort.*, 9 (2) : 65.

Singh, P. 1988. Studies on ripening and processing of *litchi* (*Litchi chinensis* Sonn.) fruits. Ph.D. Thesis, NDUA & T, Kumarganj, Faizabad, (U.P.).

Singh, R.N. 1990. Mango, I.C.A.R., New Delhi.

Tandon, D.K., Kalra, S.K., Singh, H. and Chadha, K.L. 1983. Physico-chemical characteristics of some guava varieties. *Prog. Hort*., 15 (1-2) : 42-44.

Thakur, K.S. and Barwal, V.S. 1998. Studies on preparation and evaluation of squash from unmarketable *kiwi* fruit. *Indian Fd. Pack.*, 52 (1) : 26-29.

Vyas, K.K., Sharma, P.C., Joshi, V.K. and Shrivastava, M.P. 1989. Standardization of a method for juice extraction and preparation of refreshing RTS nectar from *Rhodo* petals (*Rhododendron abroreaum*). *Indian Fd Pack.*, 43 (4) : 8-12.

* - Original not seen

Flow sheet for preparation of fruit nectar and RTS beverages

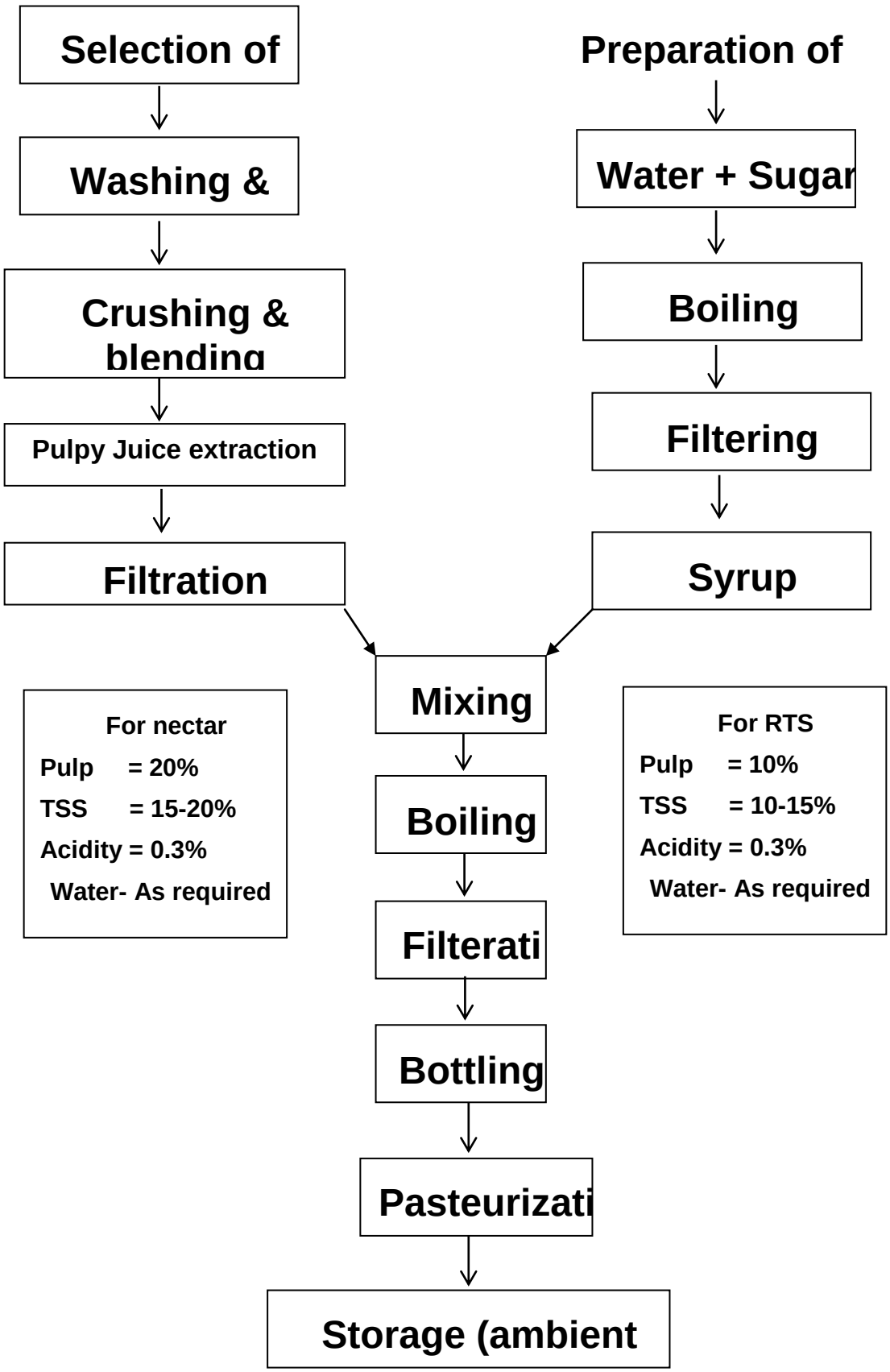

Table 3.1 : Weekly meteorological data during storage period of guava nectar and RTS

Week No.	Date	Temperature (^{o}C)		Rain-Fall (mm)	Relative Humidity (%)		Sun Shine (hours)
		Max.	Min.		I	II	
	2003						
48	Nov 26-02	29.5	14.8	000.0	94	45	8.5
49	Dec 03-09	28.6	10.7	000.0	92	30	9.1
50	10-16	27.9	12.8	005.6	91	44	7.6
51	17-23	25.5	11.2	000.0	94	39	7.6
52	24-31	24.9	10.8	011.5	92	46	7.2
	2004						
1	Jan 01-07	26.0	10.9	0.0	95	45	8.5
2	08-14	26.3	9.3	0.0	93	33	9.1
3	15-21	29.9	13.5	0.0	91	40	9.0
4	22-28	25.9	12.9	21.0	90	54	7.0
5	29-04	24.0	13.5	34.2	93	63	4.9
6	Feb 05-11	26.1	9.5	1.8	89	31	9.4
7	12-18	30.0	12.4	0.0	87	29	9.6
8	19-25	31.8	13.4	0.0	86	27	9.7
9	26-04	33.0	14.6	0.0	86	25	9.2
10	Mar 05-11	33.6	15.8	1.6	78	29	9.3
11	12-18	37.0	16.4	0.0	78	18	9.5
12	19-25	39.8	18.6	0.0	65	12	9.3
13	26-01	37.6	23.0	10.0	70	34	7.9
14	Apr 02-08	38.4	21.5	1.4	67	21	7.7
15	09-15	41.4	24.0	0.0	51	15	9.9
16	16-22	42.3	24.3	0.0	42	12	10.3
17	23-29	38.0	23.4	2.8	64	31	9.2
18	30-06	39.5	26.6	0.0	48	25	8.1
19	May 07-13	41.3	28.9	2.8	51	23	7.9
20	14-20	41.3	28.3	3.6	53	25	6.4
21	21-27	42.2	27.2	2.5	44	19	8.6
22	28-03	41.8	28.3	0.0	46	23	9.5
23	Jun 04-10	40.2	27.4	5.6	69	38	8.3
24	11-17	32.6	24.6	227.8	86	66	4.0

Table 4. 2 : Effect of different cultivars and recipes on ascorbic acid (mg/100 ml) of stored guava nectar

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	4.25	5.25	6.67	4.50	5.17	3.58	5.00	6.08	4.25	4.73	3.08	4.83	5.92	3.50	4.33
T_2 : 20% pulp, 0.3% acidity and 16% TSS	5.83	5.92	6.58	5.08	5.85	5.33	6.08	6.50	5.00	5.73	5.17	5.67	6.17	4.67	5.42
T_3 : 20% pulp, 0.3% acidity and 17% TSS	6.58	6.92	7.58	5.25	6.58	6.00	6.08	7.25	5.08	6.10	5.58	5.92	6.92	4.83	5.81
T_4 : 20% pulp, 0.3% acidity and 18% TSS	5.83	6.08	5.67	4.33	5.48	5.42	5.75	5.58	4.42	5.29	4.83	5.42	5.25	4.33	4.96
T_5 : 20% pulp, 0.3% acidity and 19% TSS	3.50	4.58	4.42	2.25	3.69	3.00	4.25	4.25	2.17	3.42	2.75	4.25	4.08	2.00	3.27
T_6 : 20% pulp, 0.3% acidity and 20% TSS	3.25	4.75	6.08	4.18	4.57	3.00	4.50	5.75	4.25	4.37	2.75	4.25	5.50	2.75	3.81
Mean	4.87	5.58	6.17	4.27	5.22	4.39	5.28	5.90	4.19	4.94	4.03	5.06	5.64	3.68	4.60

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0067	0.019	0.0071	0.020	0.0076	0.022
Recipe	0.0082	0.023	0.0087	0.025	0.0093	0.026
Cultivar x Recipe	0.0164	0.047	0.0175	0.050	0.0186	0.053

Contd..

Contd..

Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	3.17	4.33	5.83	3.00	4.08	2.83	3.75	5.50	2.50	3.69	2.27	3.67	5.25	2.00	2.29
T_2 : 20% pulp, 0.3% acidity and 16% TSS	4.75	5.42	6.17	4.50	5.21	3.92	3.92	5.67	3.42	4.37	3.67	4.42	5.42	3.00	4.12
T_3 : 20% pulp, 0.3% acidity and 17% TSS	5.17	5.67	6.83	4.67	5.58	4.50	4.50	6.50	4.25	5.12	4.33	5.08	5.67	4.00	4.77
T_4 : 20% pulp, 0.3% acidity and 18% TSS	4.83	5.33	5.17	3.83	4.79	4.33	5.25	5.42	3.50	4.56	3.66	4.83	4.17	2.67	3.83
T_5 : 20% pulp, 0.3% acidity and 19% TSS	2.50	3.42	3.25	1.50	2.67	2.25	2.50	3.25	1.25	2.31	2.00	2.50	3.00	1.13	2.16
T_6 : 20% pulp, 0.3% acidity and 20% TSS	2.50	4.17	5.08	2.50	3.50	1.75	3.75	4.92	1.91	3.08	1.33	3.50	4.75	1.33	2.73
Mean	3.82	4.72	5.39	3.29	4.31	3.26	4.15	5.21	2.80	3.86	2.88	4.00	4.71	2.35	3.48

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0066	0.019	0.0081	0.023	0.0077	0.022
Recipe	0.0081	0.023	0.0099	0.019	0.0095	0.027
Cultivar x Recipe	0.0162	0.046	0.0199	0.056	0.0191	0.038

Table 4. 3 : Effect of different cultivars and recipes on acidity (%) of stored guava nectar

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	0.32	0.32	0.32	0.33	0.32	0.42	0.32	0.34	0.37	0.36	0.45	0.43	0.39	0.49	0.44
T_2 : 20% pulp, 0.3% acidity and 16% TSS	0.31	0.32	0.33	0.33	0.32	0.36	0.35	0.32	0.39	0.35	0.42	0.39	0.36	0.45	0.41
T_3 : 20% pulp, 0.3% acidity and 17% TSS	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.41	0.34	0.37	0.38	0.34	0.43	0.38
T_4 : 20% pulp, 0.3% acidity and 18% TSS	0.33	0.32	0.33	0.33	0.33	0.40	0.37	0.33	0.43	0.38	0.47	0.47	0.42	0.53	0.47
T_5 : 20% pulp, 0.3% acidity and 19% TSS	0.32	0.32	0.32	0.34	0.33	0.52	0.35	0.32	0.52	0.43	0.50	0.49	0.46	0.58	0.50
T_6 : 20% pulp, 0.3% acidity and 20% TSS	0.32	0.34	0.33	0.33	0.33	0.54	0.35	0.32	0.61	0.46	0.53	0.51	0.48	0.61	0.53
Mean	0.32	0.32	0.32	0.33	0.32	0.43	0.34	0.32	0.46	0.39	0.46	0.44	0.41	0.51	0.46

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	-	N.S.	0.004	0.011	0.003	0.008
Recipe	-	N.S.	0.004	0.011	0.004	0.011
Cultivar x Recipe	-	N.S.	-	N.S.	-	N.S.

Contd..

Contd..

Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	0.55	0.49	0.48	0.63	0.54	0.70	0.59	0.46	0.75	0.62	0.87	0.76	0.63	1.03	0.82
T_2 : 20% pulp, 0.3% acidity and 16% TSS	0.52	0.46	0.42	0.59	0.50	0.65	0.57	0.46	0.70	0.59	0.83	0.72	0.58	0.97	0.77
T_3 : 20% pulp, 0.3% acidity and 17% TSS	0.49	0.42	0.39	0.45	0.44	0.60	0.51	0.43	0.67	0.55	0.77	0.65	0.49	0.90	0.70
T_4 : 20% pulp, 0.3% acidity and 18% TSS	0.59	0.53	0.49	0.66	0.57	0.73	0.62	0.49	0.78	0.66	0.90	0.81	0.68	1.06	0.86
T_5 : 20% pulp, 0.3% acidity and 19% TSS	0.64	0.56	0.52	0.69	0.60	0.77	0.66	0.57	0.82	0.70	0.94	0.86	0.74	1.09	0.91
T_6 : 20% pulp, 0.3% acidity and 20% TSS	0.67	0.59	0.55	0.72	0.63	0.80	0.69	0.62	0.84	0.74	0.98	0.90	0.79	1.11	0.94
Mean	0.58	0.51	0.47	0.62	0.54	0.71	0.61	0.50	0.76	0.64	0.88	0.78	0.65	1.02	0.83

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.002	0.005	0.005	0.014	0.004	0.011
Recipe	0.003	0.008	0.007	0.019	0.005	0.014
Cultivar x Recipe	-	NS	-	NS	-	NS

Table 4. 4 : Effect of different cultivars and recipes on pH of stored guava nectar

Recipe \ Cultivar	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	3.94	4.33	4.37	4.25	4.22	4.09	4.14	4.25	4.14	4.16	3.97	4.04	4.15	3.95	4.03
T_2 : 20% pulp, 0.3% acidity and 16% TSS	4.31	4.33	5.19	4.15	4.49	4.19	4.14	5.23	4.13	4.42	3.83	3.97	5.00	3.89	4.17
T_3 : 20% pulp, 0.3% acidity and 17% TSS	4.41	5.43	5.89	4.31	5.01	4.37	5.28	5.36	4.18	4.80	4.11	4.97	5.06	4.04	4.54
T_4 : 20% pulp, 0.3% acidity and 18% TSS	4.28	4.41	4.86	4.26	4.45	4.16	4.30	4.70	4.12	4.32	3.94	4.06	4.50	3.82	4.08
T_5 : 20% pulp, 0.3% acidity and 19% TSS	4.36	4.41	4.46	3.51	4.19	4.12	4.15	4.22	3.14	3.91	3.86	4.07	4.10	2.99	3.75
T_6 : 20% pulp, 0.3% acidity and 20% TSS	4.30	4.28	4.36	3.20	4.04	3.70	4.13	4.17	3.11	3.78	3.50	4.04	4.02	2.85	3.60
Mean	4.27	4.53	4.86	3.95	4.40	4.11	4.35	4.66	3.81	4.23	3.87	4.19	4.47	3.59	4.03

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.007	0.019	0.006	0.018	0.006	0.017
Recipe	0.009	0.025	0.008	0.022	0.007	0.019
Cultivar x Recipe	0.018	0.051	0.016	0.045	0.015	0.042

Contd..

Contd..

Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	2.80	3.75	3.91	3.50	3.49	2.71	3.65	3.83	2.54	3.18	2.30	3.45	3.65	2.29	2.92
T_2 : 20% pulp, 0.3% acidity and 16% TSS	3.65	3.75	4.95	3.71	4.01	3.49	3.65	4.70	3.70	3.89	3.29	3.45	4.64	3.27	3.66
T_3 : 20% pulp, 0.3% acidity and 17% TSS	3.74	4.84	5.06	3.88	4.38	3.67	4.50	4.85	3.81	4.21	3.42	4.25	4.65	3.44	3.94
T_4 : 20% pulp, 0.3% acidity and 18% TSS	3.67	3.73	3.91	3.75	3.77	3.54	3.66	3.79	3.69	3.67	3.34	3.43	3.60	3.28	3.41
T_5 : 20% pulp, 0.3% acidity and 19% TSS	3.74	3.71	3.91	2.65	3.50	3.44	3.60	3.77	2.23	3.26	3.27	3.35	3.57	2.25	3.11
T_6 : 20% pulp, 0.3% acidity and 20% TSS	3.10	3.70	3.86	2.37	3.26	2.64	3.61	3.75	2.11	3.03	2.23	3.37	3.50	2.00	2.77
Mean	3.45	3.91	4.27	3.31	3.73	3.25	3.78	4.11	3.01	3.54	2.97	3.55	3.94	2.75	3.30

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.009	0.025	0.010	0.028	0.011	0.031
Recipe	0.012	0.034	0.013	0.036	0.013	0.036
Cultivar x Recipe	0.023	0.065	0.025	0.071	0.027	0.077

Table 4. 5 : Effect of different cultivars and recipes on total soluble solids (%) of stored guava nectar

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	15.00	15.00	15.00	15.00	15.00	15.24	15.15	15.05	15.30	15.18	15.27	15.30	15.15	15.42	15.28
T_2 : 20% pulp, 0.3% acidity and 16% TSS	16.03	16.00	16.00	16.00	16.01	16.17	16.08	16.00	16.25	16.12	16.20	16.20	16.10	16.35	16.21
T_3 : 20% pulp, 0.3% acidity and 17% TSS	17.03	17.02	17.00	17.0	17.01	17.13	17.00	17.00	17.20	17.08	17.13	17.05	17.05	17.28	17.13
T_4 : 20% pulp, 0.3% acidity and 18% TSS	18.05	18.03	18.00	18.00	18.02	18.28	18.22	18.08	18.35	18.23	18.35	18.35	18.20	18.49	18.35
T_5 : 20% pulp, 0.3% acidity and 19% TSS	18.68	19.03	19.00	19.00	18.93	19.34	19.28	19.11	19.41	19.28	19.45	19.40	19.25	19.56	19.41
T_6 : 20% pulp, 0.3% acidity and 20% TSS	19.67	20.03	20.00	20.00	19.92	20.39	20.35	20.14	20.45	20.33	20.50	20.45	20.35	20.68	20.49
Mean	17.41	17.51	17.50	17.50	17.48	17.76	17.68	17.56	17.83	17.71	17.82	17.79	17.68	17.96	17.81

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	-	NS	0.0020	0.005	0.0017	0.005
Recipe	0.176	0.50	0.0024	0.006	0.0021	0.006
Cultivar x Recipe	-	NS	0.0049	0.014	0.0042	0.012

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Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	**AS**	**L-49**	**R-72**	**Mean**	**AC**	**AS**	**L-49**	**R-72**	**Mean**	**AC**	**AS**	**L-49**	**R-72**	**Mean**
T_1 : 20% pulp, 0.3% acidity and 15% TSS	15.30	15.30	15.19	15.47	15.31	15.35	15.30	15.22	15.50	15.30	15.40	15.30	15.24	15.52	15.35
T_2 : 20% pulp, 0.3% acidity and 16% TSS	16.25	16.25	16.15	16.40	16.26	16.30	16.25	16.15	16.45	16.28	16.35	16.25	16.15	16.47	16.31
T_3 : 20% pulp, 0.3% acidity and 17% TSS	17.20	17.09	19.09	17.33	17.18	17.25	17.15	17.10	17.33	17.20	17.30	17.15	17.10	17.40	17.24
T_4 : 20% pulp, 0.3% acidity and 18% TSS	18.35	18.37	18.24	18.54	18.38	18.40	18.37	18.25	18.55	18.39	18.45	18.37	18.25	18.57	18.41
T_5 : 20% pulp, 0.3% acidity and 19% TSS	19.45	19.43	19.29	19.61	17.44	19.45	19.43	19.30	19.61	19.45	19.50	19.43	19.30	19.63	19.46
T_6 : 20% pulp, 0.3% acidity and 20% TSS	20.50	20.47	20.35	20.68	20.50	20.50	20.47	20.35	20.69	20.50	20.55	20.47	20.35	20.72	20.51
Mean	17.84	17.81	17.72	18.00	17.85	17.87	17.83	17.72	18.02	17.82	17.92	17.83	17.74	18.04	17.88

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0019	0.005	0.0020	0.006	0.0019	0.005
Recipe	0.0023	0.006	0.0024	0.007	0.0023	0.006
Cultivar x Recipe	0.0046	0.013	0.0049	0.014	0.0046	0.013

Table 4. 6 : Effect of different cultivars and recipes on reducing sugar (%) of stored guava nectar

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	4.46	4.15	4.00	4.70	4.33	4.61	4.30	4.15	4.72	4.44	5.16	4.73	4.40	5.68	4.99
T_2 : 20% pulp, 0.3% acidity and 16% TSS	5.37	5.00	4.85	5.55	5.19	5.43	5.15	5.00	5.72	5.32	5.95	5.60	5.32	6.50	5.84
T_3 : 20% pulp, 0.3% acidity and 17% TSS	6.17	5.85	5.75	6.35	6.03	6.30	6.00	5.90	6.50	6.17	6.78	6.43	6.15	7.29	6.66
T_4 : 20% pulp, 0.3% acidity and 18% TSS	7.59	7.35	7.15	7.85	7.48	7.74	7.48	7.30	8.00	7.63	8.38	7.86	7.57	8.94	8.19
T_5 : 20% pulp, 0.3% acidity and 19% TSS	8.70	8.50	8.25	9.00	8.61	8.85	8.65	8.40	9.15	8.76	9.58	9.02	8.75	10.08	9.36
T_6 : 20% pulp, 0.3% acidity and 20% TSS	9.87	9.75	9.35	10.10	9.77	9.95	9.90	9.50	10.30	9.91	10.83	10.15	9.92	11.22	10.53
Mean	7.03	6.77	6.56	7.26	6.90	7.15	6.91	6.71	7.40	7.04	7.78	7.30	7.02	8.28	7.59

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0030	0.0085	0.0023	0.0065	0.0024	0.0068
Recipe	0.0036	0.0102	0.0028	0.0079	0.0030	0.0085
Cultivar x Recipe	0.0072	0.0205	0.0056	0.0159	0.0059	0.0168

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Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	5.99	5.26	4.54	6.96	5.69	6.89	5.89	5.25	8.10	6.53	7.00	6.86	5.65	8.86	7.09
T_2 : 20% pulp, 0.3% acidity and 16% TSS	6.86	6.06	5.43	7.67	6.50	7.66	6.70	5.90	8.85	7.28	7.79	7.66	6.49	9.66	7.90
T_3 : 20% pulp, 0.3% acidity and 17% TSS	7.72	6.82	6.30	8.47	7.33	8.40	7.40	6.62	9.57	7.99	8.63	8.40	7.24	10.40	8.67
T_4 : 20% pulp, 0.3% acidity and 18% TSS	9.17	8.57	7.80	10.12	8.91	10.12	9.12	8.49	11.32	9.76	10.23	10.02	8.84	12.08	10.29
T_5 : 20% pulp, 0.3% acidity and 19% TSS	10.39	9.75	8.99	11.44	10.14	11.46	10.36	9.68	12.57	11.02	11.52	11.24	10.10	13.27	11.53
T_6 : 20% pulp, 0.3% acidity and 20% TSS	11.53	10.95	10.18	12.68	11.33	12.77	11.63	10.81	13.84	12.26	13.02	12.43	11.27	14.43	12.79
Mean	8.61	7.90	7.21	9.56	8.32	9.55	8.52	7.79	10.71	9.14	9.69	9.43	8.27	11.45	9.71

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0022	0.0063	0.0020	0.0057	0.0082	0.0233
Recipe	0.0027	0.0077	0.0025	0.0071	0.0100	0.0284
Cultivar x Recipe	0.0054	0.0153	0.0050	0.0142	0.0200	0.0569

Table 4. 7 : Effect of different cultivars and recipes on total sugar (%) of stored guava nectar

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	14.25	14.15	14.05	14.35	14.20	14.30	14.20	14.10	14.40	14.25	14.38	14.33	14.16	14.55	14.36
T_2 : 20% pulp, 0.3% acidity and 16% TSS	15.25	15.15	15.05	15.35	15.20	15.30	15.20	15.10	15.40	15.25	15.35	15.35	15.12	15.52	15.33
T_3 : 20% pulp, 0.3% acidity and 17% TSS	16.25	16.15	16.05	16.35	16.20	16.30	16.20	16.10	16.40	16.25	16.31	16.25	16.10	16.49	16.28
T_4 : 20% pulp, 0.3% acidity and 18% TSS	17.25	17.15	17.05	17.35	17.20	17.30	17.18	17.10	17.40	17.25	17.41	17.37	17.17	17.56	17.38
T_5 : 20% pulp, 0.3% acidity and 19% TSS	18.25	18.15	18.05	18.35	18.20	18.30	18.20	18.10	18.40	18.25	18.44	18.42	18.21	18.59	18.42
T_6 : 20% pulp, 0.3% acidity and 20% TSS	19.25	19.15	19.05	19.35	19.20	19.30	19.20	19.10	19.40	19.25	19.48	19.46	19.25	19.62	19.45
Mean	16.75	16.65	16.55	16.85	16.70	16.80	16.70	16.60	16.90	16.75	16.89	16.86	16.67	17.05	16.87

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.016	0.04	0.016	0.04	0.0027	0.0076
Recipe	0.019	0.05	0.020	0.05	0.0034	0.0096
Cultivar x Recipe	-	NS	-	NS	0.0067	0.0190

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Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	14.41	14.35	14.20	14.58	14.39	14.51	14.48	14.38	14.67	14.51	14.63	14.58	14.46	14.76	14.61
T_2 : 20% pulp, 0.3% acidity and 16% TSS	15.37	15.31	15.16	15.52	15.34	15.47	15.42	15.34	15.63	15.46	15.58	15.52	15.41	15.64	15.55
T_3 : 20% pulp, 0.3% acidity and 17% TSS	16.33	16.24	16.12	16.49	16.29	16.42	16.35	16.25	16.57	16.39	16.52	16.45	16.35	16.64	16.49
T_4 : 20% pulp, 0.3% acidity and 18% TSS	17.43	17.39	17.26	17.60	17.43	17.59	17.52	17.42	17.75	17.57	17.70	17.61	17.53	17.80	17.66
T_5 : 20% pulp, 0.3% acidity and 19% TSS	18.53	18.43	18.30	18.66	18.48	18.68	18.58	18.49	18.79	18.63	18.78	18.67	18.60	18.87	18.73
T_6 : 20% pulp, 0.3% acidity and 20% TSS	19.57	19.48	19.36	19.71	19.53	19.79	19.63	19.54	19.86	19.70	20.16	19.72	19.66	19.93	19.87
Mean	16.95	16.87	16.73	17.09	16.91	17.08	16.99	16.90	17.21	17.05	17.23	17.09	17.00	17.28	17.15

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0027	0.0076	0.0022	0.0060	0.0027	0.0076
Recipe	0.0033	0.0093	0.0027	0.0070	0.0340	0.0960
Cultivar x Recipe	0.0067	0.0190	0.0054	0.0153	0.0690	0.1960

Table 4 . 8 : Effect of different cultivars and recipes on non-reducing sugar (%) of stored guava nectar

Cultivar / Recipe	0 (at the time of preparation)					Storage period (in days) 30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	9.79	10.00	10.07	9.65	9.88	9.69	9.90	9.95	9.68	9.80	9.22	9.60	9.76	8.87	9.36
T_2 : 20% pulp, 0.3% acidity and 16% TSS	9.88	10.17	10.20	9.80	10.01	9.87	10.07	10.10	9.88	9.98	9.40	9.75	9.80	9.02	9.49
T_3 : 20% pulp, 0.3% acidity and 17% TSS	10.07	10.30	10.36	10.03	10.17	10.00	10.20	10.26	9.90	10.07	9.53	9.82	9.95	9.20	9.62
T_4 : 20% pulp, 0.3% acidity and 18% TSS	9.66	9.80	9.90	9.50	9.71	9.56	9.70	9.80	9.40	9.61	9.03	9.51	9.60	8.62	9.19
T_5 : 20% pulp, 0.3% acidity and 19% TSS	9.55	9.65	9.80	9.35	9.59	9.45	9.55	9.70	9.25	9.49	8.86	9.40	9.46	8.51	9.06
T_6 : 20% pulp, 0.3% acidity and 20% TSS	9.38	9.40	9.70	9.25	9.43	9.35	9.30	9.60	9.10	9.34	8.65	9.31	9.33	8.40	8.92
Mean	9.72	9.89	9.99	9.59	9.80	9.65	9.79	9.89	9.53	9.71	9.11	9.56	9.65	8.77	9.27

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0058	0.016	0.0033	0.0094	0.0019	0.005
Recipe	0.0071	0.020	0.0041	0.0120	0.0023	0.006
Cultivar x Recipe	0.0141	0.040	0.0081	0.0230	0.0046	0.013

Contd..

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Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	**AS**	**L-49**	**R-72**	**Mean**	**AC**	**AS**	**L-49**	**R-72**	**Mean**	**AC**	**AS**	**L-49**	**R-72**	**Mean**
T_1 : 20% pulp, 0.3% acidity and 15% TSS	8.42	9.09	9.66	7.62	8.69	7.62	8.59	9.13	6.57	7.98	7.63	7.72	8.81	5.90	7.51
T_2 : 20% pulp, 0.3% acidity and 16% TSS	8.51	9.25	9.73	7.81	8.83	7.81	8.72	9.44	6.78	8.19	7.79	7.86	8.92	6.03	7.65
T_3 : 20% pulp, 0.3% acidity and 17% TSS	8.61	9.42	9.82	8.02	8.97	8.02	8.95	9.63	7.00	8.40	7.99	8.05	9.11	6.24	7.85
T_4 : 20% pulp, 0.3% acidity and 18% TSS	8.30	8.82	9.46	7.48	8.51	7.47	8.40	8.93	6.43	7.81	7.47	7.59	8.69	5.72	7.37
T_5 : 20% pulp, 0.3% acidity and 19% TSS	8.14	8.68	9.31	7.22	8.34	7.22	8.22	8.81	6.22	7.62	7.26	7.43	8.50	5.60	7.19
T_6 : 20% pulp, 0.3% acidity and 20% TSS	8.04	8.53	9.18	7.03	8.19	7.02	8.00	8.73	6.02	7.44	7.13	7.29	8.39	5.50	7.08
Mean	8.34	8.96	9.53	7.53	8.59	7.53	8.48	9.11	6.50	7.90	7.54	7.66	8.74	5.83	7.44

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0038	0.0110	0.0020	0.0057	0.0017	0.0050
Recipe	0.0046	0.0130	0.0024	0.0068	0.0020	0.0060
Cultivar x Recipe	0.0092	0.0260	0.0049	0.0140	0.0041	0.0120

Table 4 . 9 : Effect of different cultivars and recipes on organoleptic quality of stored guava nectar

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	21.80	23.92	24.93	20.82	22.87	20.80	22.62	24.56	19.28	21.81	20.14	21.89	23.95	19.10	21.27
T_2 : 20% pulp, 0.3% acidity and 16% TSS	23.76	25.93	25.96	22.27	24.48	22.73	24.91	25.28	21.16	23.52	21.06	22.26	24.83	20.13	22.07
T_3 : 20% pulp, 0.3% acidity and 17% TSS	25.22	26.97	27.00	24.27	25.87	24.85	25.86	26.19	23.26	25.04	23.15	24.07	26.11	23.26	24.15
T_4 : 20% pulp, 0.3% acidity and 18% TSS	20.23	21.99	24.00	18.87	21.29	19.78	20.85	23.21	18.12	20.49	19.06	19.83	22.53	18.02	19.86
T_5 : 20% pulp, 0.3% acidity and 19% TSS	19.12	20.93	22.90	17.17	20.03	18.12	19.13	22.13	17.02	19.10	18.04	18.93	20.92	16.90	18.70
T_6 : 20% pulp, 0.3% acidity and 20% TSS	18.09	19.91	20.87	16.09	18.74	17.09	18.11	20.06	16.03	17.82	16.97	17.83	19.78	15.87	17.61
Mean	21.37	23.28	24.28	19.92	22.21	20.56	21.91	23.57	19.14	21.29	19.74	20.80	23.02	18.88	20.61

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0078	0.0220	0.0106	0.0300	0.0092	0.0260
Recipe	0.0095	0.0270	0.0130	0.0370	0.0112	0.0320
Cultivar x Recipe	0.0190	0.0540	0.0260	0.0740	0.0225	0.0640

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Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 20% pulp, 0.3% acidity and 15% TSS	19.95	20.88	22.76	18.86	20.61	17.90	19.38	21.85	17.27	19.09	16.52	18.29	20.27	16.00	17.77
T_2 : 20% pulp, 0.3% acidity and 16% TSS	20.33	21.03	23.95	19.92	21.31	18.93	20.88	22.43	18.00	20.18	18.83	19.00	21.55	17.89	19.32
T_3 : 20% pulp, 0.3% acidity and 17% TSS	23.13	23.35	25.46	22.13	23.52	20.42	22.97	24.43	21.13	22.24	19.65	21.65	23.44	20.15	21.22
T_4 : 20% pulp, 0.3% acidity and 18% TSS	18.32	18.80	21.55	17.25	18.98	16.83	18.00	20.44	16.06	17.83	15.29	17.00	19.32	14.83	16.61
T_5 : 20% pulp, 0.3% acidity and 19% TSS	17.02	17.98	20.17	16.00	17.79	15.77	16.76	19.13	14.83	16.62	13.93	15.98	18.00	13.00	15.23
T_6 : 20% pulp, 0.3% acidity and 20% TSS	16.00	16.73	18.94	14.85	16.63	14.29	15.65	17.94	13.00	15.22	12.54	14.32	16.79	11.82	13.87
Mean	19.12	19.80	22.14	18.17	19.81	17.36	18.94	21.11	16.71	18.53	16.13	17.71	19.89	15.61	17.34

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0101	0.0290	0.0162	0.0460	0.0143	0.0410
Recipe	0.0124	0.0350	0.0198	0.0560	0.0175	0.0500
Cultivar x Recipe	0.0247	0.0700	0.0396	0.1130	0.0350	0.0990

Table 4 . 10 : Effect of different cultivars and recipes on ascorbic acid (mg/100ml) of stored guava RTS

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	3.87	4.56	6.50	3.50	4.61	3.78	4.52	6.50	3.50	4.57	3.60	4.47	6.33	3.43	4.46
T_2 : 10% pulp, 0.3% acidity and 11% TSS	4.42	5.67	8.25	3.75	5.52	4.33	5.63	8.25	3.75	5.49	4.25	5.50	8.07	3.66	5.37
T_3 : 10% pulp, 0.3% acidity and 12% TSS	4.60	7.67	9.75	3.75	6.44	4.60	7.67	9.75	3.58	6.40	4.50	7.50	9.25	3.56	6.20
T_4 : 10% pulp, 0.3% acidity and 13% TSS	4.58	5.75	7.83	3.00	5.29	4.50	5.60	7.50	3.23	5.21	4.50	5.52	7.50	3.21	5.18
T_5 : 10% pulp, 0.3% acidity and 14% TSS	3.54	4.50	5.68	2.72	4.11	3.54	4.83	5.67	2.50	4.14	3.50	4.65	5.50	2.62	4.07
T_6 : 10% pulp, 0.3% acidity and 15% TSS	3.50	3.25	4.75	3.12	3.65	3.50	3.25	4.50	2.75	3.50	3.50	3.25	4.30	2.64	3.42
Mean	4.08	5.23	7.13	3.31	4.94	4.04	5.25	7.03	3.22	4.88	3.98	5.15	6.83	3.19	4.78

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.039	0.110	0.038	0.110	0.024	0.070
Recipe	0.048	0.140	0.046	0.130	0.029	0.080
Cultivar x Recipe	0.096	0.270	0.093	0.260	0.059	0.170

Contd..

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Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	3.50	4.25	6.25	3.29	4.32	2.85	4.19	5.64	3.16	3.96	2.50	3.22	5.26	2.00	3.25
T_2 : 10% pulp, 0.3% acidity and 11% TSS	4.00	5.25	8.05	3.51	5.20	3.08	4.16	7.25	2.68	4.29	2.93	3.25	7.09	2.13	3.85
T_3 : 10% pulp, 0.3% acidity and 12% TSS	4.25	7.25	9.15	3.52	6.04	4.07	6.50	8.99	2.91	5.62	3.50	5.53	8.37	2.17	4.89
T_4 : 10% pulp, 0.3% acidity and 13% TSS	4.25	5.25	7.25	3.16	4.98	4.06	4.64	6.13	2.78	4.40	3.50	4.02	5.76	2.29	3.89
T_5 : 10% pulp, 0.3% acidity and 14% TSS	3.25	4.25	5.48	2.42	3.85	3.14	3.50	4.99	2.38	3.50	2.74	3.00	4.16	2.15	3.01
T_6 : 10% pulp, 0.3% acidity and 15% TSS	3.25	3.55	4.23	2.58	3.40	3.09	3.50	3.64	2.44	3.17	2.62	3.25	3.25	2.22	2.84
Mean	3.75	4.97	6.74	3.08	4.63	3.38	4.42	6.11	2.72	4.16	2.97	3.71	5.65	2.84	3.62

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.038	0.110	0.024	0.070	0.021	0.060
Recipe	0.046	0.130	0.030	0.080	0.025	0.070
Cultivar x Recipe	0.093	0.260	0.061	0.170	0.051	0.140

Table 4 . 11 : Effect of different cultivars and recipes on acidity (%) of stored guava RTS

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	0.32	0.32	0.32	0.32	0.32	0.37	0.35	0.32	0.40	0.36	0.42	0.36	0.34	0.52	0.41
T_2 : 10% pulp, 0.3% acidity and 11% TSS	0.32	0.32	0.32	0.32	0.32	0.36	0.33	0.32	0.35	0.34	0.47	0.35	0.34	0.42	0.39
T_3 : 10% pulp, 0.3% acidity and 12% TSS	0.32	0.32	0.32	0.32	0.32	0.33	0.32	0.32	0.35	0.33	0.35	0.33	0.32	0.39	0.35
T_4 : 10% pulp, 0.3% acidity and 13% TSS	0.32	0.32	0.32	0.32	0.32	0.42	0.36	0.32	0.48	0.39	0.53	0.38	0.35	0.59	0.46
T_5 : 10% pulp, 0.3% acidity and 14% TSS	0.32	0.32	0.32	0.32	0.32	0.45	0.38	0.39	0.50	0.43	0.40	0.48	0.47	0.59	0.48
T_6 : 10% pulp, 0.3% acidity and 15% TSS	0.32	0.32	0.32	0.32	0.32	0.48	0.40	0.32	0.62	0.45	0.55	0.40	0.38	0.69	0.50
Mean	0.32	0.32	0.32	0.32	0.32	0.40	0.36	0.33	0.45	0.38	0.45	0.38	0.37	0.53	0.44

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	-	NS	0.003	0.008	0.003	0.008
Recipe	-	NS	0.003	0.008	0.004	0.011
Cultivar x Recipe	-	NS	0.006	0.017	0.007	0.019

Contd..

Contd..

Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	0.50	0.44	0.45	0.64	0.51	0.79	0.52	0.42	0.86	0.65	0.84	0.67	0.68	0.98	0.79
T_2 : 10% pulp, 0.3% acidity and 11% TSS	0.57	0.44	0.42	0.52	0.49	0.67	0.52	0.48	0.73	0.60	0.84	0.57	0.54	0.92	0.72
T_3 : 10% pulp, 0.3% acidity and 12% TSS	0.40	0.37	0.34	0.41	0.38	0.42	0.44	0.42	0.49	0.44	0.79	0.54	0.49	0.84	0.66
T_4 : 10% pulp, 0.3% acidity and 13% TSS	0.68	0.43	0.39	0.69	0.55	0.80	0.61	0.54	0.77	0.68	0.89	0.96	0.68	0.90	0.86
T_5 : 10% pulp, 0.3% acidity and 14% TSS	0.49	0.58	0.58	0.69	0.58	0.80	0.63	0.59	0.86	0.72	0.86	0.87	0.87	0.99	0.90
T_6 : 10% pulp, 0.3% acidity and 15% TSS	0.65	0.48	0.46	0.84	0.61	0.75	0.67	0.68	0.95	0.76	0.97	0.98	0.85	0.99	0.95
Mean	0.55	0.46	0.44	0.63	0.52	0.70	0.56	0.52	0.78	0.64	0.86	0.76	0.68	0.94	0.81

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.005	0.014	0.008	0.022	0.006	0.017
Recipe	0.006	0.017	0.011	0.031	0.007	0.019
Cultivar x Recipe	0.013	0.036	0.021	0.059	0.015	0.042

Table 4 . 12 : Effect of different cultivars and recipes on pH of stored guava RTS

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	3.45	3.43	4.25	3.15	3.57	3.15	3.27	4.18	3.05	4.41	3.00	3.17	3.89	2.94	3.25
T_2 : 10% pulp, 0.3% acidity and 11% TSS	3.45	4.44	4.63	3.18	3.93	3.14	4.32	4.36	3.09	3.73	2.94	4.21	4.20	2.95	3.58
T_3 : 10% pulp, 0.3% acidity and 12% TSS	3.63	4.69	5.74	3.42	4.37	3.45	4.41	5.47	3.15	4.12	3.16	4.26	5.26	3.04	3.93
T_4 : 10% pulp, 0.3% acidity and 13% TSS	3.53	3.70	4.67	3.25	3.79	3.31	3.42	4.45	3.14	3.58	3.06	3.25	4.22	2.92	3.36
T_5 : 10% pulp, 0.3% acidity and 14% TSS	3.48	3.43	4.54	3.20	3.66	3.26	3.28	4.25	3.08	3.47	3.06	3.11	4.00	2.96	3.29
T_6 : 10% pulp, 0.3% acidity and 15% TSS	3.46	3.43	3.65	3.19	3.43	3.26	3.28	3.35	3.08	3.24	3.04	3.04	3.18	2.93	3.05
Mean	3.50	3.85	4.58	3.23	3.79	3.26	3.66	4.34	3.09	3.59	3.04	3.51	4.13	2.95	3.41

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.007	0.019	0.008	0.022	0.011	0.031
Recipe	0.009	0.025	0.009	0.025	0.013	0.037
Cultivar x Recipe	0.019	0.016	0.019	0.054	0.027	0.077

Contd..

Contd..

Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	2.85	2.90	3.50	2.78	3.01	2.68	2.76	3.25	2.49	2.79	2.53	2.65	3.00	2.46	2.66
T_2 : 10% pulp, 0.3% acidity and 11% TSS	2.84	3.96	4.00	2.83	3.41	2.72	3.77	3.68	2.56	3.18	2.59	3.66	3.25	2.55	3.01
T_3 : 10% pulp, 0.3% acidity and 12% TSS	3.04	4.03	5.15	2.87	3.77	2.82	3.85	4.99	2.62	3.57	2.75	3.72	4.87	2.60	3.48
T_4 : 10% pulp, 0.3% acidity and 13% TSS	2.86	2.96	4.11	2.81	3.18	2.71	2.81	3.86	2.61	2.99	2.63	2.69	3.50	2.45	2.82
T_5 : 10% pulp, 0.3% acidity and 14% TSS	2.84	2.93	3.86	2.80	3.11	2.68	2.76	3.50	2.51	2.86	2.60	2.66	3.15	2.46	2.72
T_6 : 10% pulp, 0.3% acidity and 15% TSS	2.82	2.92	3.04	2.79	2.89	2.64	2.75	2.83	2.49	2.68	2.58	2.59	2.74	2.41	2.58
Mean	2.88	3.28	3.94	2.81	3.23	2.71	3.12	3.68	2.55	3.01	2.61	2.99	3.42	2.49	2.88

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.009	0.025	0.007	0.019	0.008	0.023
Recipe	0.012	0.034	0.009	0.025	0.011	0.028
Cultivar x Recipe	0.024	0.068	0.018	0.051	0.021	0.059

Table 4 . 13 : Effect of different cultivars and recipes on total soluble solids (%) of stored guava RTS

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	10.03	10.05	10.00	10.05	10.04	10.20	10.08	10.06	10.22	10.18	10.25	10.17	10.08	10.25	10.17
T_2 : 10% pulp, 0.3% acidity and 11% TSS	11.03	11.03	11.00	11.00	11.02	11.20	11.06	11.03	11.25	11.12	11.25	11.28	11.06	11.30	11.21
T_3 : 10% pulp, 0.3% acidity and 12% TSS	12.05	12.00	12.00	12.02	12.01	12.05	12.03	12.01	12.27	12.09	12.28	12.18	12.03	12.17	12.17
T_4 : 10% pulp, 0.3% acidity and 13% TSS	13.03	13.05	13.00	13.02	13.02	13.22	13.13	13.09	13.22	13.14	13.22	13.22	13.12	13.25	13.17
T_5 : 10% pulp, 0.3% acidity and 14% TSS	14.02	14.00	14.00	14.02	14.01	14.23	14.15	14.12	14.32	14.67	14.32	14.22	14.16	14.48	14.28
T_6 : 10% pulp, 0.3% acidity and 15% TSS	15.05	15.02	15.00	15.03	15.02	15.22	15.17	15.15	15.30	15.17	15.30	15.18	15.18	15.38	15.25
Mean	12.54	12.52	12.50	12.52	12.52	12.68	12.60	12.50	12.76	12.63	12.77	12.71	12.56	12.81	12.71

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.009	NS	0.009	0.025	0.0089	0.025
Recipe	0.011	0.031	0.011	0.031	0.0109	0.031
Cultivar x Recipe	0.022	NS	0.023	0.065	0.0218	0.062

Contd..

Contd..

Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	10.32	10.25	10.15	10.40	10.28	10.42	10.33	10.25	10.53	10.38	10.52	10.52	10.25	10.45	10.43
T_2 : 10% pulp, 0.3% acidity and 11% TSS	11.48	11.30	11.10	11.33	11.30	11.57	11.35	11.15	11.52	11.40	11.67	11.42	11.23	11.65	11.49
T_3 : 10% pulp, 0.3% acidity and 12% TSS	12.28	12.17	12.10	12.30	12.21	12.35	12.15	12.15	12.42	12.27	12.45	12.25	12.20	12.58	12.37
T_4 : 10% pulp, 0.3% acidity and 13% TSS	13.35	13.25	13.20	13.35	13.29	13.35	13.25	13.25	13.43	13.32	13.43	13.25	13.35	13.62	13.41
T_5 : 10% pulp, 0.3% acidity and 14% TSS	14.38	14.48	14.20	14.52	14.39	14.49	14.52	14.23	14.65	14.47	14.55	14.52	14.25	14.83	14.54
T_6 : 10% pulp, 0.3% acidity and 15% TSS	15.32	15.42	15.28	15.68	15.42	15.62	15.50	15.28	15.68	15.52	15.63	15.58	15.32	15.78	15.58
Mean	12.85	12.81	12.67	12.90	12.82	12.96	12.85	12.72	13.04	12.89	13.04	12.92	12.77	13.15	12.97

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.011	0.033	0.016	0.047	0.022	0.062
Recipe	0.014	0.041	0.020	0.057	0.027	0.076
Cultivar x Recipe	0.028	0.081	0.040	0.115	0.054	0.154

Table 4 . 14 : Effect of different cultivars and recipes on reducing sugar (%) of stored guava RTS

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	1.63	1.34	0.95	1.84	1.44	2.15	1.68	1.27	2.59	1.92	2.59	2.25	1.54	3.63	2.50
T_2 : 10% pulp, 0.3% acidity and 11% TSS	2.39	2.23	1.95	2.68	2.31	2.99	2.53	2.16	3.40	2.77	3.37	3.05	2.70	4.37	3.37
T_3 : 10% pulp, 0.3% acidity and 12% TSS	3.26	3.11	2.75	3.52	3.16	3.83	3.41	3.05	4.20	3.62	4.15	3.85	3.22	5.10	4.08
T_4 : 10% pulp, 0.3% acidity and 13% TSS	4.74	4.45	4.10	4.98	4.57	5.29	4.79	4.38	5.79	5.06	5.81	5.45	4.70	6.89	5.71
T_5 : 10% pulp, 0.3% acidity and 14% TSS	5.85	5.54	5.19	6.09	5.67	6.46	5.92	5.49	7.00	6.22	7.02	6.65	5.86	8.15	6.92
T_6 : 10% pulp, 0.3% acidity and 15% TSS	6.97	6.68	6.28	7.20	6.78	7.63	7.07	6.60	8.19	7.37	8.25	7.85	7.02	9.42	8.14
Mean	4.17	3.89	3.54	4.38	3.99	4.72	4.23	3.82	5.19	4.49	5.19	4.85	4.17	6.25	5.12

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0022	0.006	0.0017	0.005	0.0028	0.008
Recipe	0.0026	0.007	0.0020	0.006	0.0036	0.010
Cultivar x Recipe	0.0053	0.015	0.0041	0.012	0.0067	0.019

Contd..

Contd..

Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	3.21	2.90	2.21	4.57	3.22	3.70	3.25	2.45	4.82	3.55	4.28	3.58	2.60	5.82	4.07
T_2 : 10% pulp, 0.3% acidity and 11% TSS	4.02	3.71	2.90	5.31	3.98	4.45	4.04	3.27	6.62	4.59	4.99	4.39	3.43	6.57	4.95
T_3 : 10% pulp, 0.3% acidity and 12% TSS	4.82	4.52	3.59	5.07	4.50	5.20	4.83	4.10	7.37	5.37	5.88	5.20	4.27	7.27	5.65
T_4 : 10% pulp, 0.3% acidity and 13% TSS	6.40	6.09	5.46	7.88	6.46	6.95	5.79	5.89	8.02	6.66	7.48	6.77	5.77	9.07	7.27
T_5 : 10% pulp, 0.3% acidity and 14% TSS	7.59	7.28	6.71	9.12	7.67	8.20	7.67	6.81	9.22	7.97	8.68	7.96	6.95	10.27	8.45
T_6 : 10% pulp, 0.3% acidity and 15% TSS	8.78	8.47	7.96	11.35	9.14	9.95	8.88	7.99	10.42	9.31	9.88	9.15	8.12	11.57	9.59
Mean	5.80	5.49	4.80	7.21	5.83	6.41	5.74	5.08	7.74	6.25	6.81	6.16	5.24	8.44	6.66

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0020	0.006	0.0601	0.171	0.0406	0.115
Recipe	0.0025	0.007	0.0736	0.209	0.0497	0.141
Cultivar x Recipe	0.0049	0.014	0.1472	0.419	0.0994	0.283

Table 4.15 : Effect of different cultivars and recipes on total sugars (%) of stored guava RTS

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	9.15	9.10	9.05	9.20	9.12	9.25	9.10	9.05	9.30	9.17	9.29	9.20	9.14	9.34	9.29
T_2 : 10% pulp, 0.3% acidity and 11% TSS	10.15	10.10	10.05	10.20	10.12	10.20	10.10	10.05	10.25	10.15	10.22	10.15	10.10	10.27	10.22
T_3 : 10% pulp, 0.3% acidity and 12% TSS	11.15	11.10	11.05	11.20	11.12	11.15	11.10	11.05	11.20	11.12	11.15	11.10	11.07	11.20	11.15
T_4 : 10% pulp, 0.3% acidity and 13% TSS	12.15	12.10	12.05	12.20	12.12	12.30	12.10	12.05	12.35	12.20	12.36	12.25	12.18	12.41	12.36
T_5 : 10% pulp, 0.3% acidity and 14% TSS	13.15	13.10	13.05	13.20	13.12	13.35	13.10	13.05	13.40	13.22	13.43	13.30	13.22	13.48	13.43
T_6 : 10% pulp, 0.3% acidity and 15% TSS	14.15	14.10	14.05	14.20	14.12	14.40	14.10	14.05	14.45	14.25	14.50	14.35	14.26	14.55	14.50
Mean	11.65	11.60	11.55	11.70	11.62	11.77	11.60	11.55	11.82	11.69	11.82	11.72	11.66	11.87	11.77

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0012	0.003	0.0012	0.003	0.0019	0.005
Recipe	0.0014	0.004	0.0014	0.004	0.0024	0.007
Cultivar x Recipe	-	NS	0.0029	0.008	0.0047	0.013

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Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	9.32	9.26	9.21	9.40	9.29	9.34	9.27	9.21	9.45	9.32	9.39	9.30	9.23	9.50	9.35
T_2 : 10% pulp, 0.3% acidity and 11% TSS	10.25	10.19	10.15	10.31	10.22	10.27	10.20	10.16	11.36	10.24	10.32	10.23	10.17	10.41	10.28
T_3 : 10% pulp, 0.3% acidity and 12% TSS	11.18	11.12	11.09	11.22	11.15	11.20	11.13	11.10	12.22	11.16	11.25	11.16	11.12	11.27	11.20
T_4 : 10% pulp, 0.3% acidity and 13% TSS	12.39	12.33	12.27	12.49	12.37	12.41	12.34	12.27	12.54	12.39	12.46	12.37	12.29	12.59	12.43
T_5 : 10% pulp, 0.3% acidity and 14% TSS	13.46	13.40	13.33	13.58	13.45	13.48	13.41	13.33	13.63	13.46	13.53	13.44	13.36	13.63	13.49
T_6 : 10% pulp, 0.3% acidity and 15% TSS	14.53	14.47	14.39	15.67	14.51	14.55	14.48	14.39	14.72	14.53	14.60	14.51	14.42	14.77	14.57
Mean	11.85	11.79	11.75	11.94	11.83	11.87	11.80	11.74	11.99	11.85	11.92	11.83	11.76	12.03	11.89

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0030	0.008	0.0021	0.006	0.0021	0.006
Recipe	0.0037	0.010	0.0026	0.007	0.0026	0.007
Cultivar x Recipe	0.0074	0.021	0.0051	0.014	0.0051	0.014

Table 4.16 : Effect of different cultivars and recipes on non-reducing sugar (%) of stored guava RTS

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	7.52	7.76	8.10	7.36	7.68	7.10	7.42	7.78	6.71	7.25	6.70	6.95	7.60	5.71	6.74
T_2 : 10% pulp, 0.3% acidity and 11% TSS	7.76	7.84	8.15	7.52	7.82	7.21	7.57	7.82	6.85	7.36	6.85	7.10	7.73	5.90	6.89
T_3 : 10% pulp, 0.3% acidity and 12% TSS	7.89	7.99	8.30	7.68	7.97	7.32	7.69	8.00	7.00	7.50	7.00	7.25	7.85	6.10	7.05
T_4 : 10% pulp, 0.3% acidity and 13% TSS	7.41	7.65	7.95	7.22	7.56	7.00	7.31	7.67	6.56	7.14	6.62	6.80	7.48	5.52	6.61
T_5 : 10% pulp, 0.3% acidity and 14% TSS	7.30	7.56	7.86	7.11	7.46	6.89	7.18	7.56	6.40	7.01	6.42	6.65	7.36	5.33	6.44
T_6 : 10% pulp, 0.3% acidity and 15% TSS	7.18	7.42	7.77	7.00	7.34	6.77	7.03	7.45	6.26	6.88	6.25	6.50	7.24	5.13	6.28
Mean	7.51	7.70	8.02	7.31	7.64	7.05	7.37	7.71	6.63	7.19	6.64	6.87	7.55	5.62	6.67

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0038	0.011	0.0034	0.009	0.0031	0.009
Recipe	0.0047	0.013	0.0041	0.012	0.0038	0.011
Cultivar x Recipe	0.0094	0.027	0.0083	0.024	0.0077	0.022

Contd..

Contd..

Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	6.11	6.36	7.00	4.85	6.08	5.64	6.02	6.76	4.63	5.76	5.11	5.72	6.63	3.68	5.28
T_2 : 10% pulp, 0.3% acidity and 11% TSS	6.23	6.48	7.25	5.00	6.24	5.82	6.16	6.88	4.74	5.90	5.24	5.84	6.74	3.84	5.42
T_3 : 10% pulp, 0.3% acidity and 12% TSS	6.36	6.60	7.50	6.15	6.65	6.00	6.30	7.00	4.85	6.03	5.32	5.96	6.85	4.00	5.54
T_4 : 10% pulp, 0.3% acidity and 13% TSS	5.99	6.24	6.81	4.61	5.91	5.46	5.88	6.64	4.52	5.62	4.96	5.60	6.52	3.52	5.15
T_5 : 10% pulp, 0.3% acidity and 14% TSS	5.87	6.12	6.62	4.46	5.77	5.27	5.74	6.52	4.41	5.48	4.85	5.48	6.41	3.36	5.02
T_6 : 10% pulp, 0.3% acidity and 15% TSS	5.75	6.00	6.43	4.32	5.62	5.10	5.60	6.40	4.30	5.35	4.72	5.36	6.30	3.20	4.89
Mean	6.05	6.30	6.93	4.89	6.05	5.55	5.95	6.70	4.57	5.69	5.04	5.66	6.57	3.60	5.22

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0020	0.006	0.0059	0.017	0.0019	0.005
Recipe	0.0025	0.007	0.0073	0.021	0.0024	0.007
Cultivar x Recipe	0.005	0.014	0.0145	0.041	0.0048	0.014

Table 4.17 : Effect of different cultivars and recipes on organoleptic quality of stored guava RTS

Cultivar / Recipe	Storage period (in days)														
	0 (at the time of preparation)					30					60				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	20.60	22.46	24.86	19.15	21.77	20.18	21.96	24.17	18.74	21.26	19.85	21.32	23.90	18.65	20.93
T_2 : 10% pulp, 0.3% acidity and 11% TSS	22.13	24.97	25.91	21.00	23.56	21.90	24.09	25.24	20.73	22.99	20.75	23.79	24.32	19.97	22.21
T_3 : 10% pulp, 0.3% acidity and 12% TSS	24.27	25.88	26.15	23.00	24.90	23.97	25.30	26.09	23.05	24.60	23.03	24.99	26.05	22.77	24.21
T_4 : 10% pulp, 0.3% acidity and 13% TSS	19.09	20.67	23.29	18.06	20.27	18.95	20.31	23.13	17.00	19.85	18.30	19.90	22.85	16.94	19.50
T_5 : 10% pulp, 0.3% acidity and 14% TSS	18.12	19.14	22.12	17.00	19.09	17.77	19.15	21.89	16.03	18.71	17.13	19.15	21.83	15.79	18.47
T_6 : 10% pulp, 0.3% acidity and 15% TSS	17.12	18.14	20.12	16.03	17.85	16.81	18.08	20.08	15.05	17.51	16.07	18.05	20.02	14.06	17.05
Mean	20.22	21.88	23.74	19.09	21.23	19.93	21.48	23.43	18.43	20.82	19.19	21.20	23.16	18.03	20.39

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0124	0.035	0.0145	0.041	0.0191	0.054
Recipe	0.0152	0.043	0.0178	0.051	0.0234	0.067
Cultivar x Recipe	0.0304	0.086	0.0356	0.101	0.0469	0.133

Contd..

Contd..

Cultivar / Recipe	Storage period (in days)														
	90					120					150				
	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean	AC	AS	L-49	R-72	Mean
T_1 : 10% pulp, 0.3% acidity and 10% TSS	18.59	20.80	23.09	17.75	20.06	17.87	20.00	22.21	16.91	19.25	16.02	19.24	21.74	15.94	18.23
T_2 : 10% pulp, 0.3% acidity and 11% TSS	19.05	23.04	24.05	19.81	21.49	18.69	21.89	23.93	18.84	20.84	17.14	20.24	22.75	17.84	19.49
T_3 : 10% pulp, 0.3% acidity and 12% TSS	22.92	24.17	25.67	20.85	23.40	22.43	24.05	24.91	19.89	22.82	21.07	23.15	23.85	19.79	21.97
T_4 : 10% pulp, 0.3% acidity and 13% TSS	17.29	19.66	21.95	16.56	18.87	16.59	18.96	21.01	15.22	17.94	14.96	17.94	20.02	14.03	16.74
T_5 : 10% pulp, 0.3% acidity and 14% TSS	16.00	18.02	20.91	15.23	17.54	15.56	17.69	19.96	14.02	16.81	13.58	16.03	19.00	13.02	15.41
T_6 : 10% pulp, 0.3% acidity and 15% TSS	15.06	17.02	19.65	14.02	16.44	14.27	15.97	18.25	13.01	15.38	12.39	15.00	17.24	12.05	14.17
Mean	18.15	20.45	22.56	17.37	19.63	17.57	19.76	21.71	16.31	18.84	15.86	18.60	20.77	15.45	17.67

	SEm±	C.D. at 5%	SEm±	C.D. at 5%	SEm±	C.D. at 5%
Cultivar	0.0141	0.040	0.0617	0.175	0.0139	0.039
Recipe	0.0173	0.049	0.0755	0.215	0.0170	0.048
Cultivar x Recipe	0.0347	0.099	0.1511	0.429	0.0340	0.097

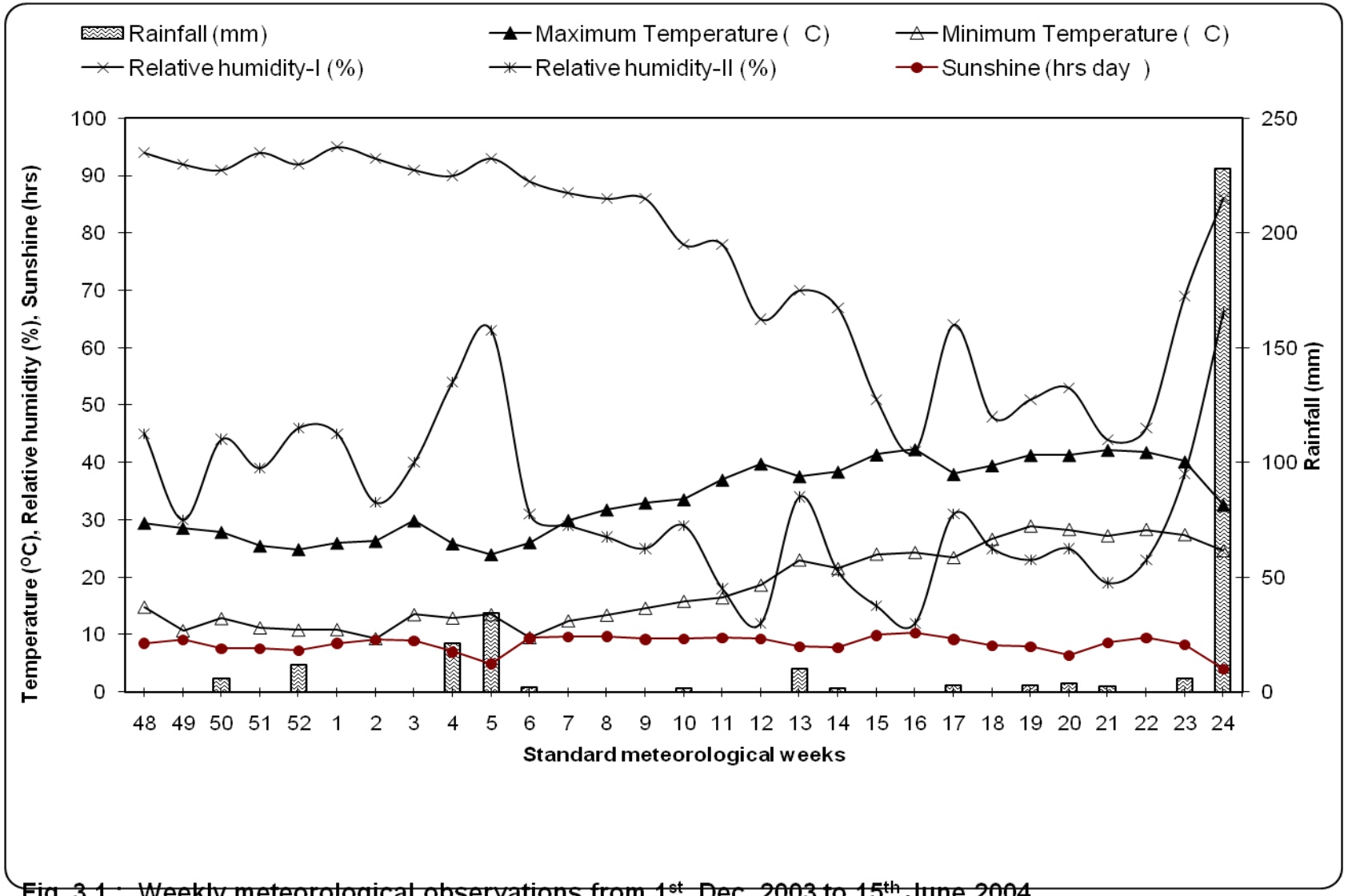
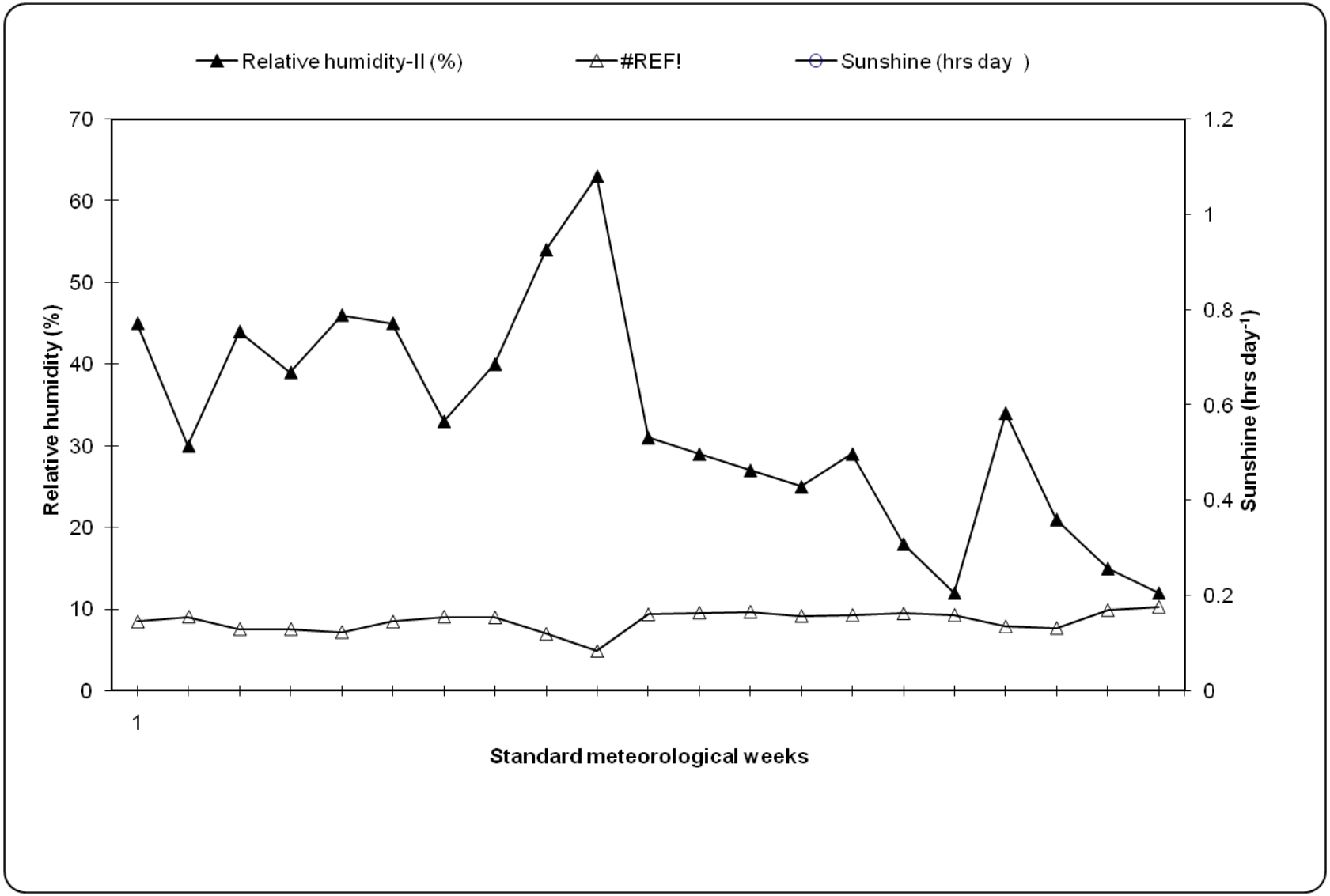
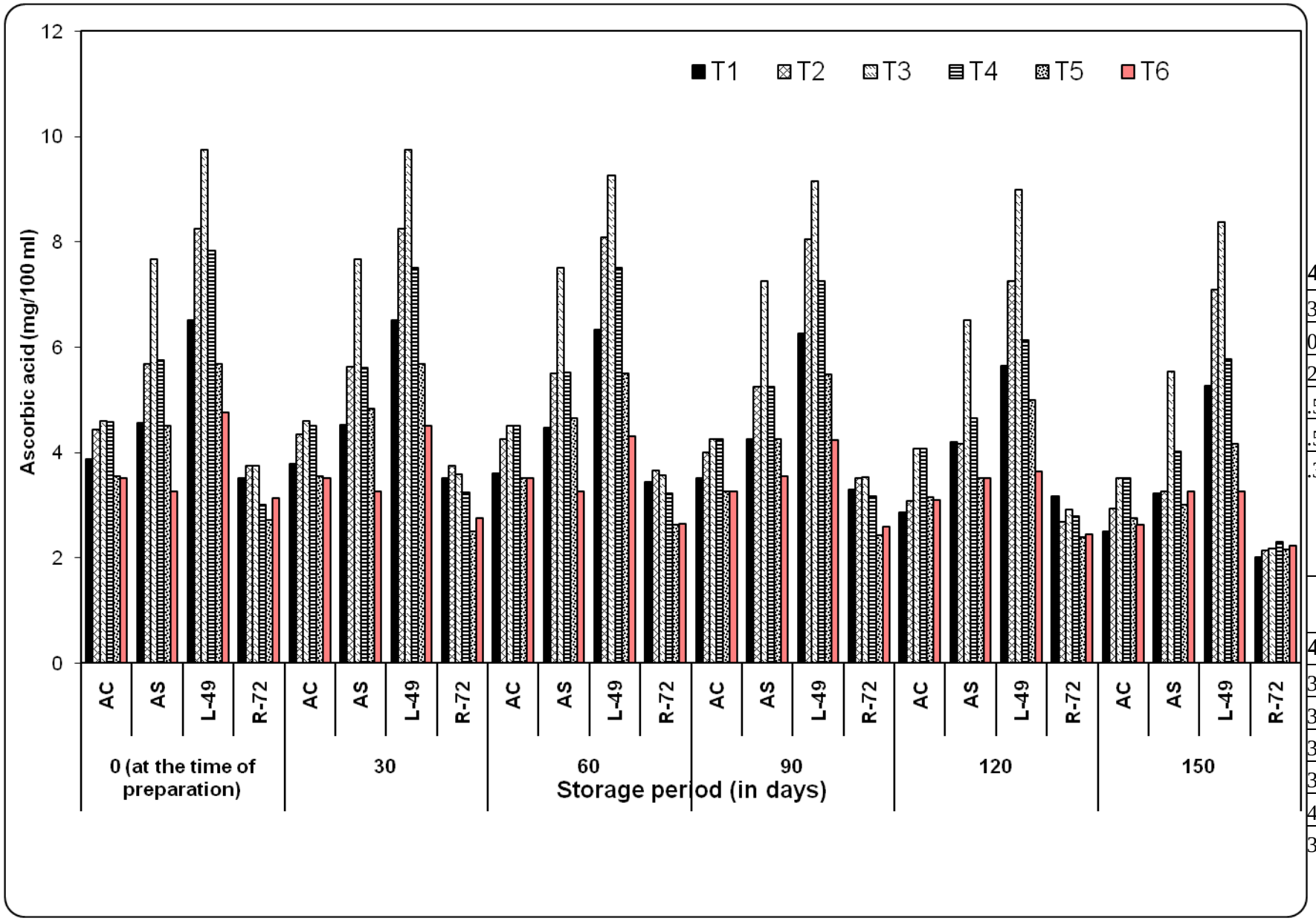


Fig. 3.1 : Weekly meteorological observations from 1st Dec. 2003 to 15th June 2004


Relative humidity-II (%)
#REF!
Sunshine (hrs day)
70
60
50
40
30
20
10
0
1.2
1
0.8
0.6
0.4
0.2
0
Relative humidity (%)
Sunshine (hrs day-1)
1
Standard meteorological weeks



49	R-72	AC
33	3.43	3.5
07	3.66	4
25	3.56	4.25
.5	3.21	4.25
.5	2.62	3.25
.3	2.64	3.25

49	R-72	AC
34	0.52	0.5
34	0.42	0.57
32	0.39	0.4
35	0.59	0.68
47	0.59	0.49
38	0.69	0.65

Fig. 4.9 : Changes in ascorbic acid (mg/ 100 ml) due to cultivars and recipe treatments in stored guava RTS

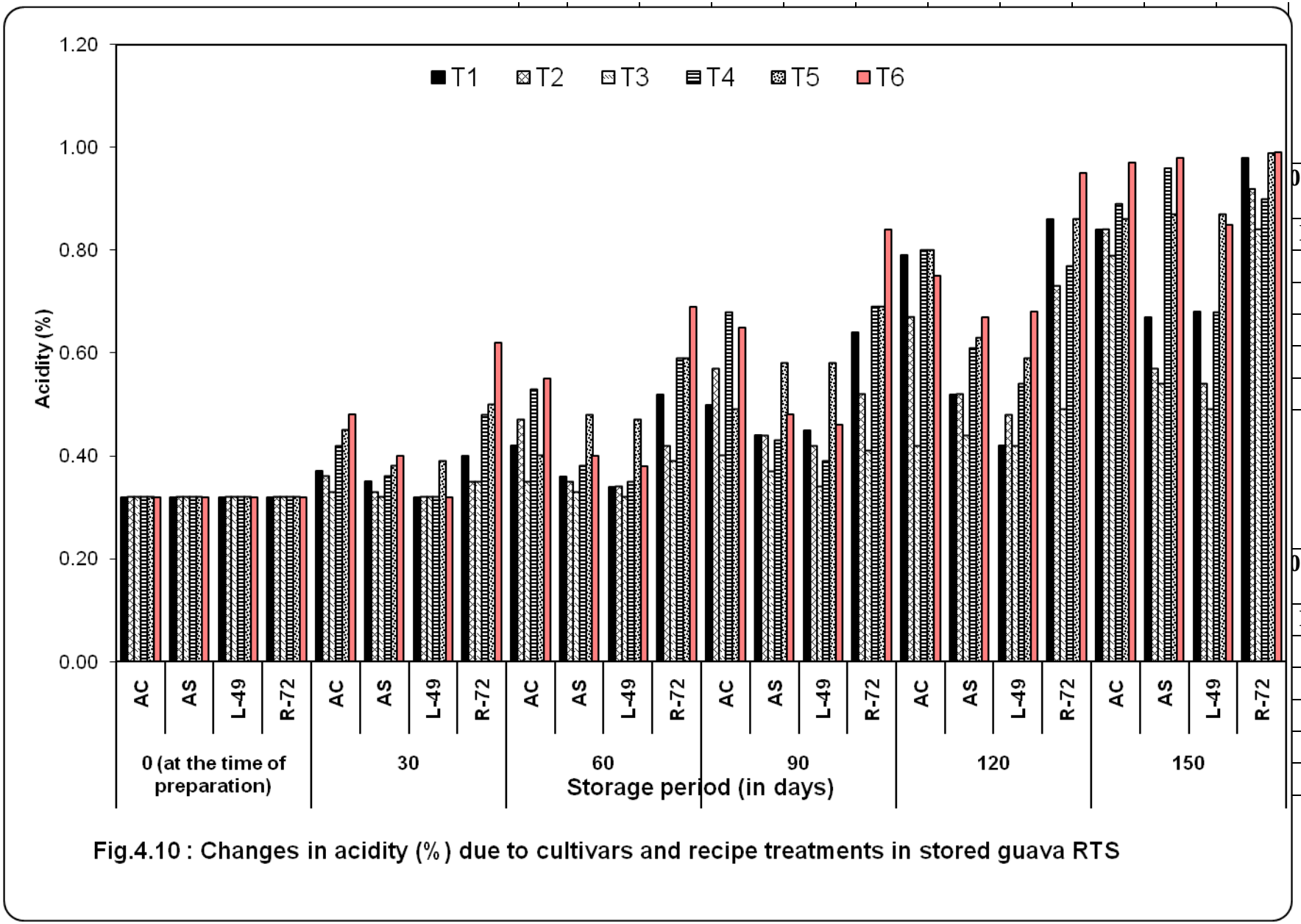


Fig.4.10 : Changes in acidity (%) due to cultivars and recipe treatments in stored guava RTS

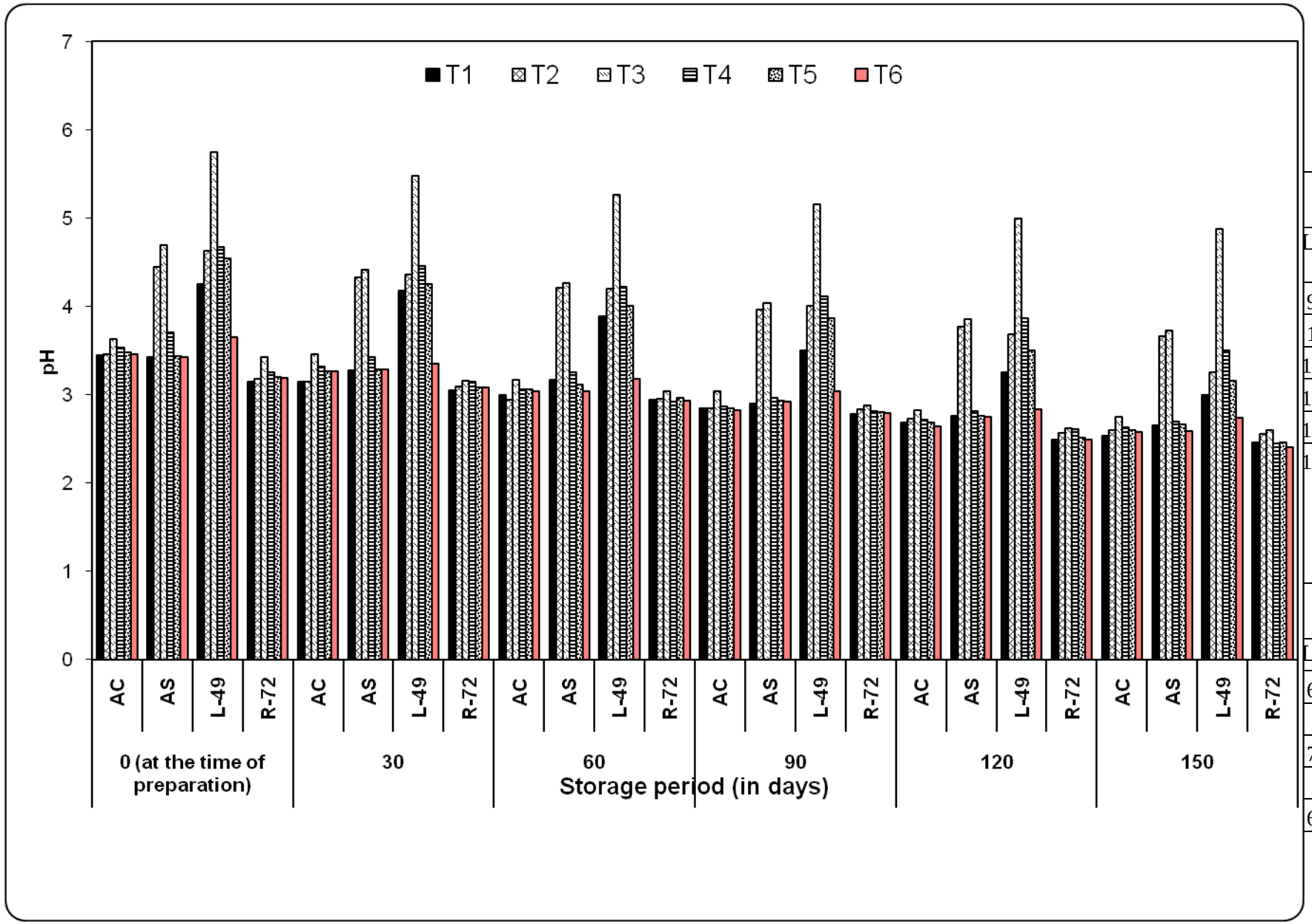
3.18	2.93	2.82

0

L-49	R-72	AC
10.08	10.25	10.32
11.06	11.3	11.48
12.03	12.17	12.28
13.12	13.25	13.35
14.16	14.48	14.38
15.18	15.38	15.32

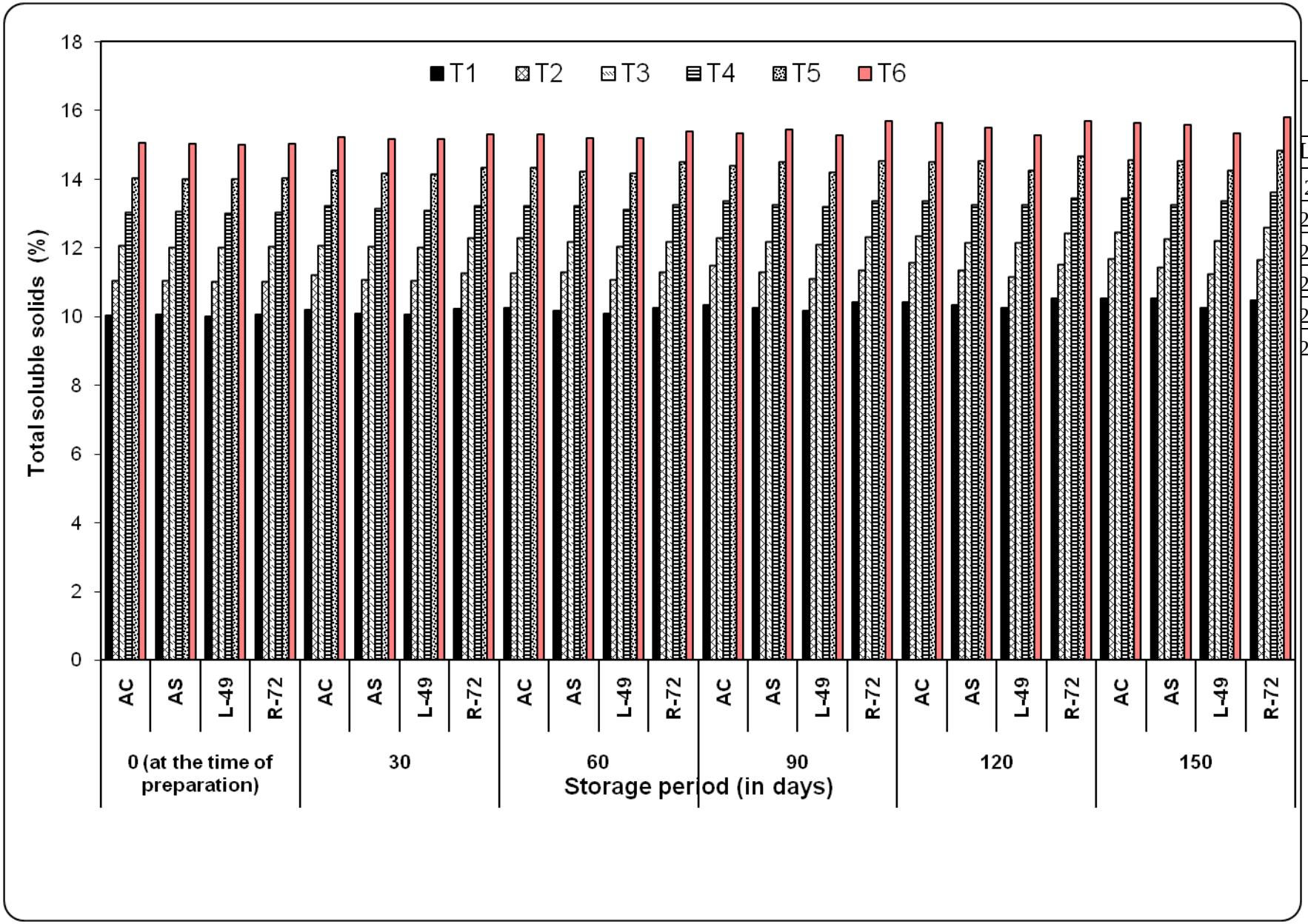
0

L-49	R-72	AC
1.54	3.63	3.21
2.7	4.37	4.02
3.22	5.1	4.82
4.7	6.89	6.4
5.86	8.15	7.59
7.02	9.42	8.78

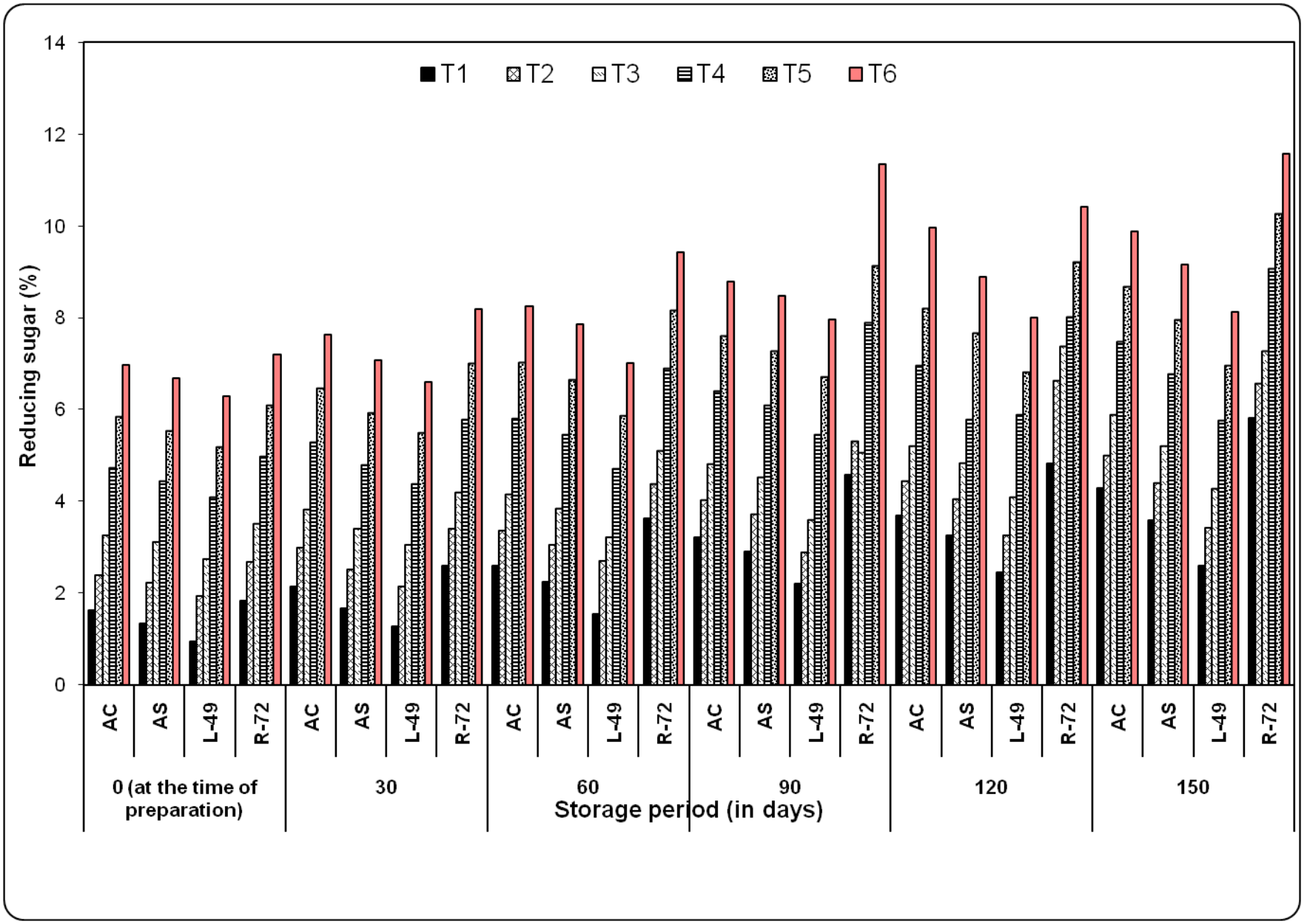


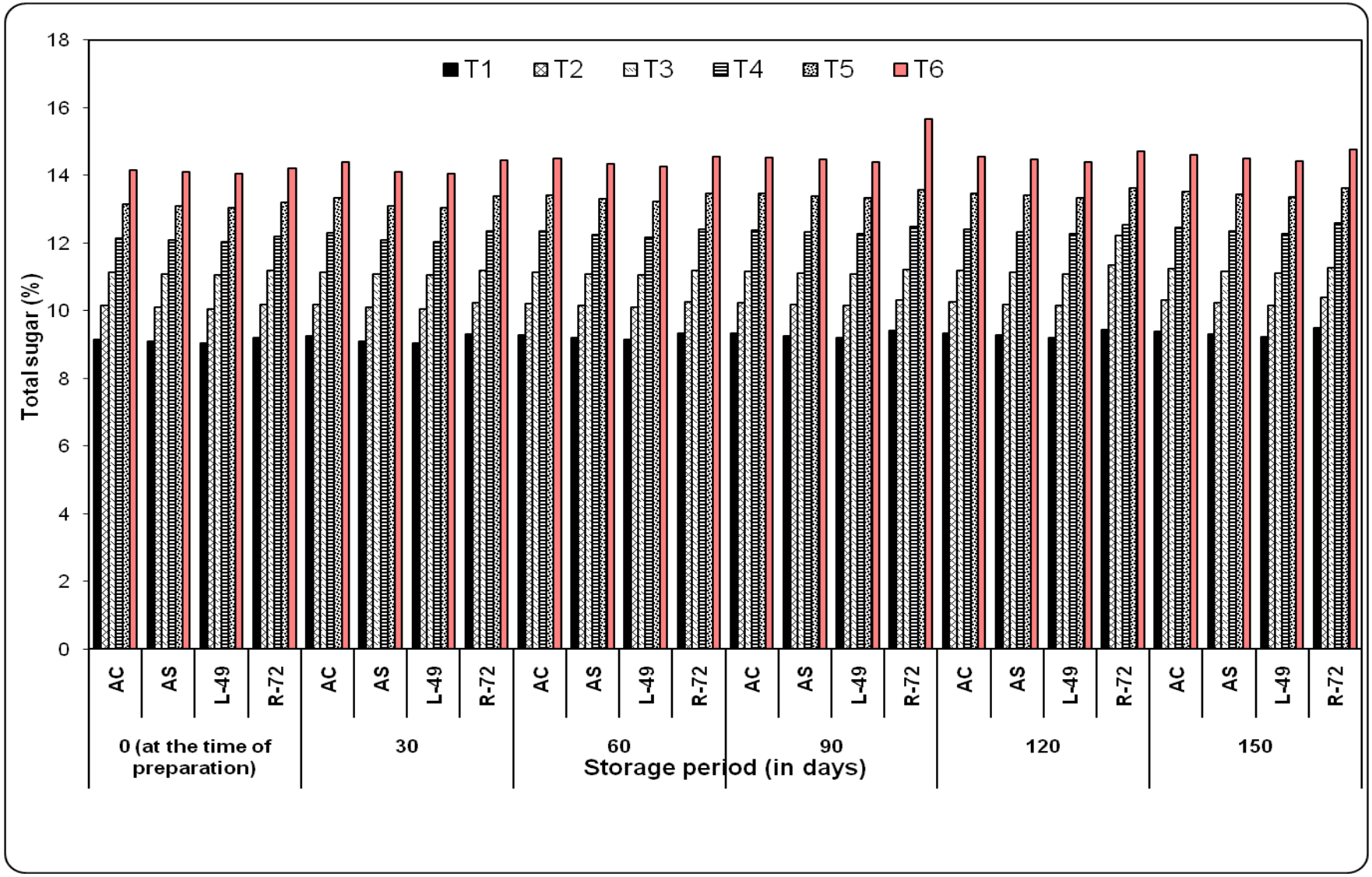
L-49	**R-72**	**AC**
9.14	9.34	9.32
10.1	10.27	10.25
11.07	11.2	11.18
12.18	12.41	12.39
13.22	13.48	13.46
14.26	14.55	14.53

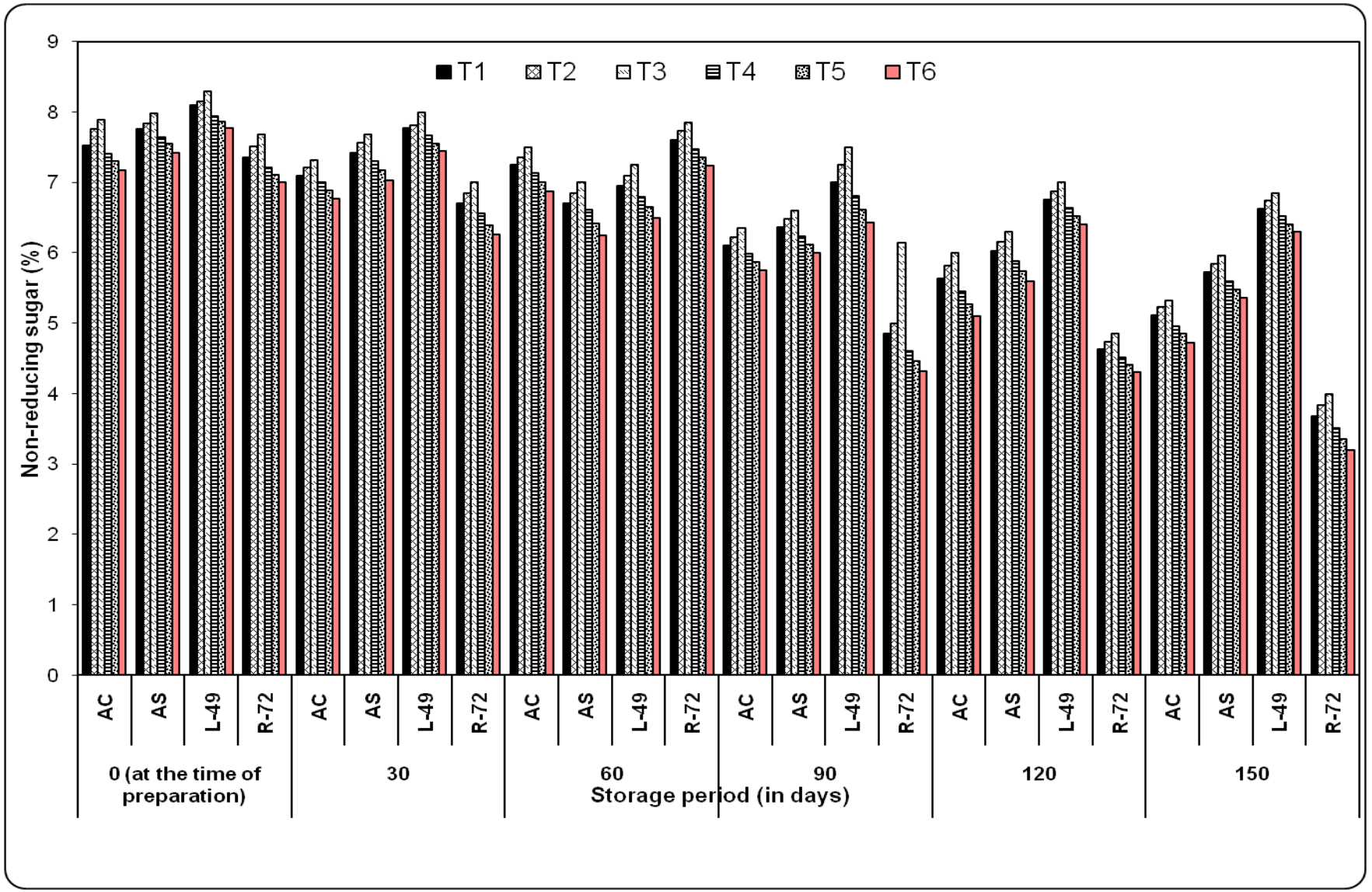
L-49	**R-72**	**AC**
6.95	7.6	6.11
7.1	7.73	6.23
7.25	7.85	6.36
6.8	7.48	5.99
6.65	7.36	5.87
6.5	7.24	5.75



L-49	**R-72**	**AC**
23.9	18.65	18.59
24.32	19.97	19.05
26.05	22.77	22.92
22.85	16.94	17.29
21.83	15.79	16
20.02	14.06	15.06


T1
T2
T3
T4
T5
T6
Reducing sugar (%)
0
2
4
6
8
10
12
14
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)


T1
T2
T3
T4
T5
T6
Total sugar (%)
0
2
4
6
8
10
12
14
16
18
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)


T1
T2
T3
T4
T5
T6
Non-reducing sugar (%)
0
1
2
3
4
5
6
7
8
9
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)

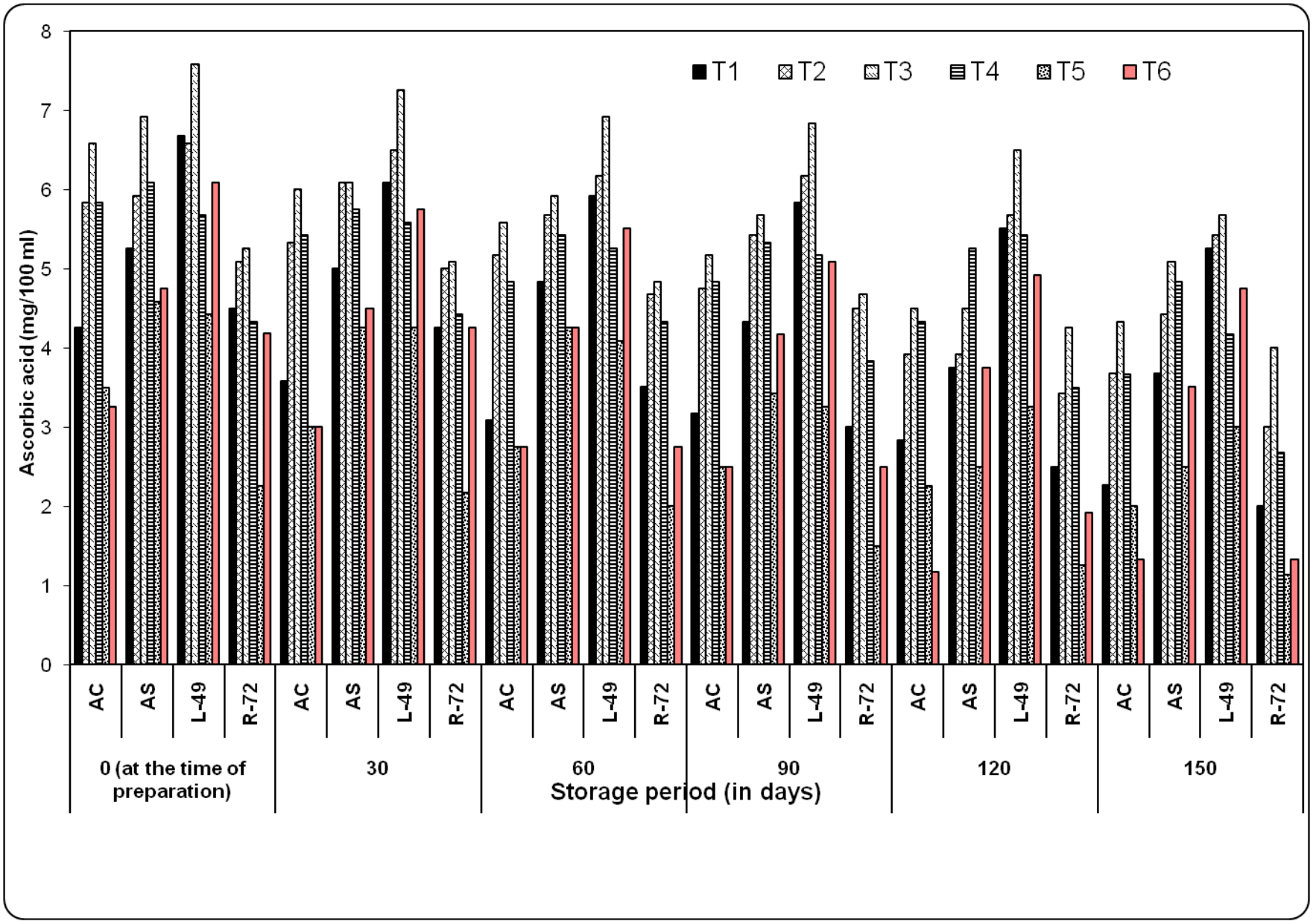


Fig. 4.1 : Changes in ascorbic acid (mg/ 100 ml) due to cultivars and recipe treatments in stored guava nectar

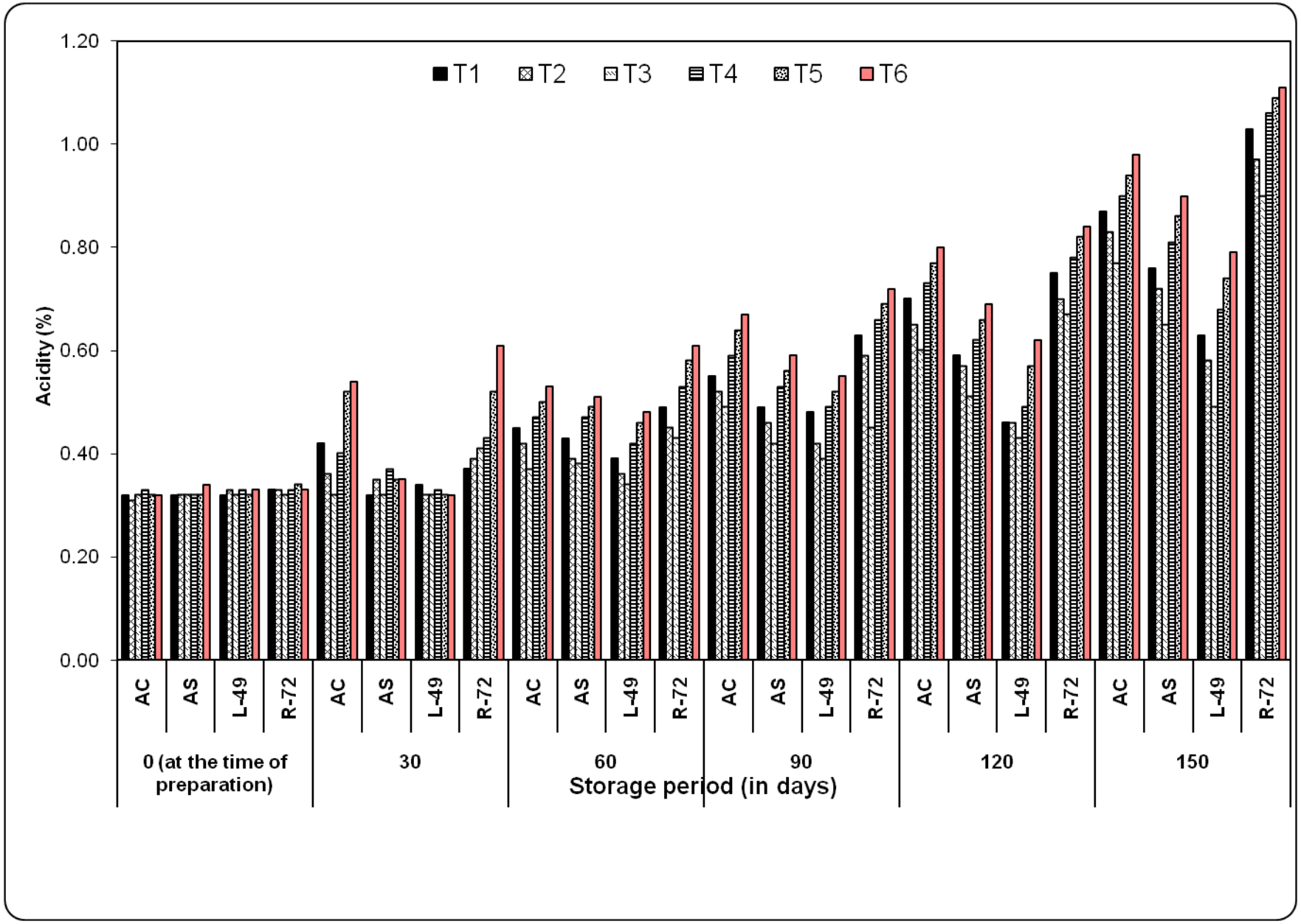


Fig.4.2 : Changes in acidity (%) due to cultivars and recipe treatments in stored guava nectar

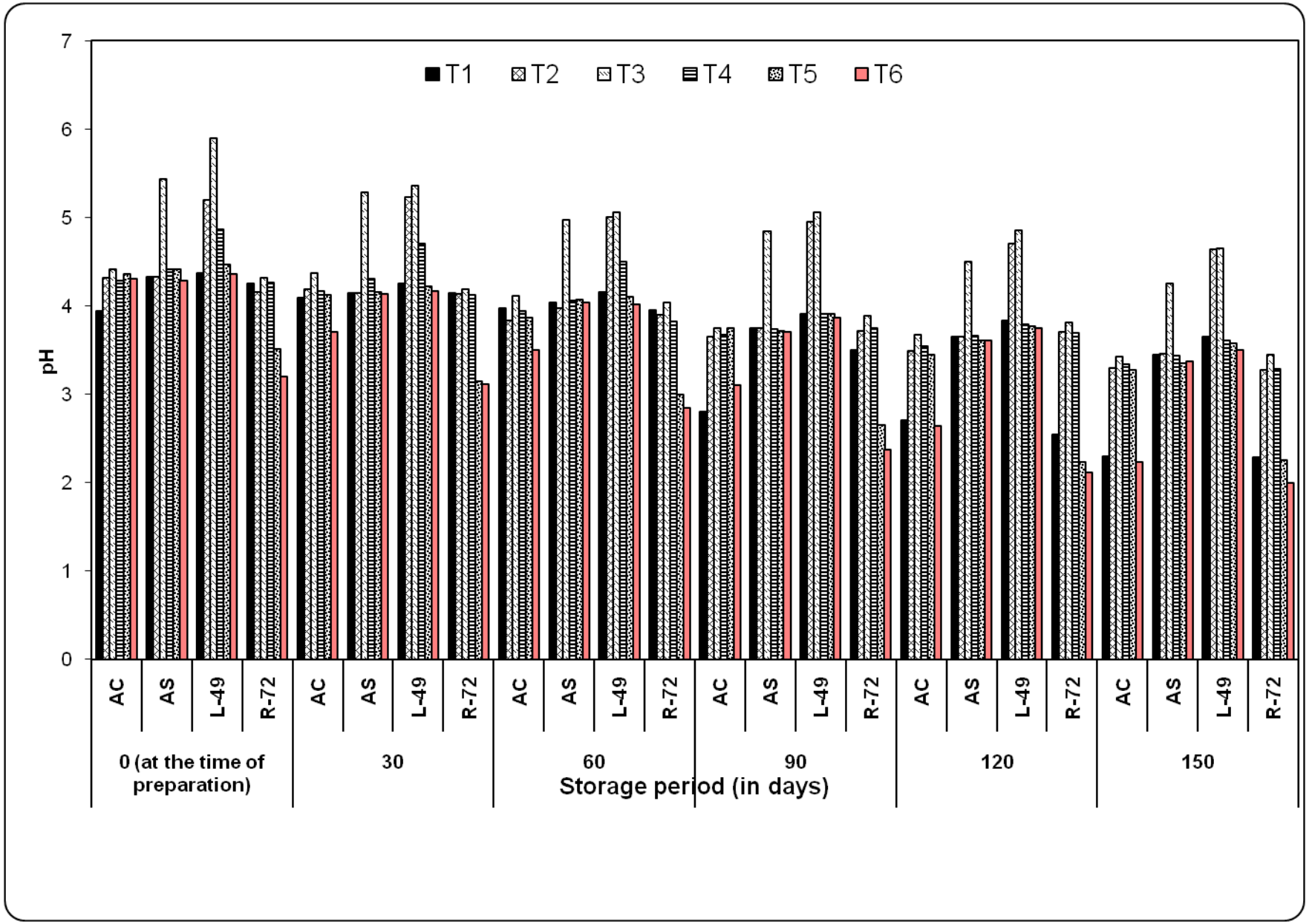
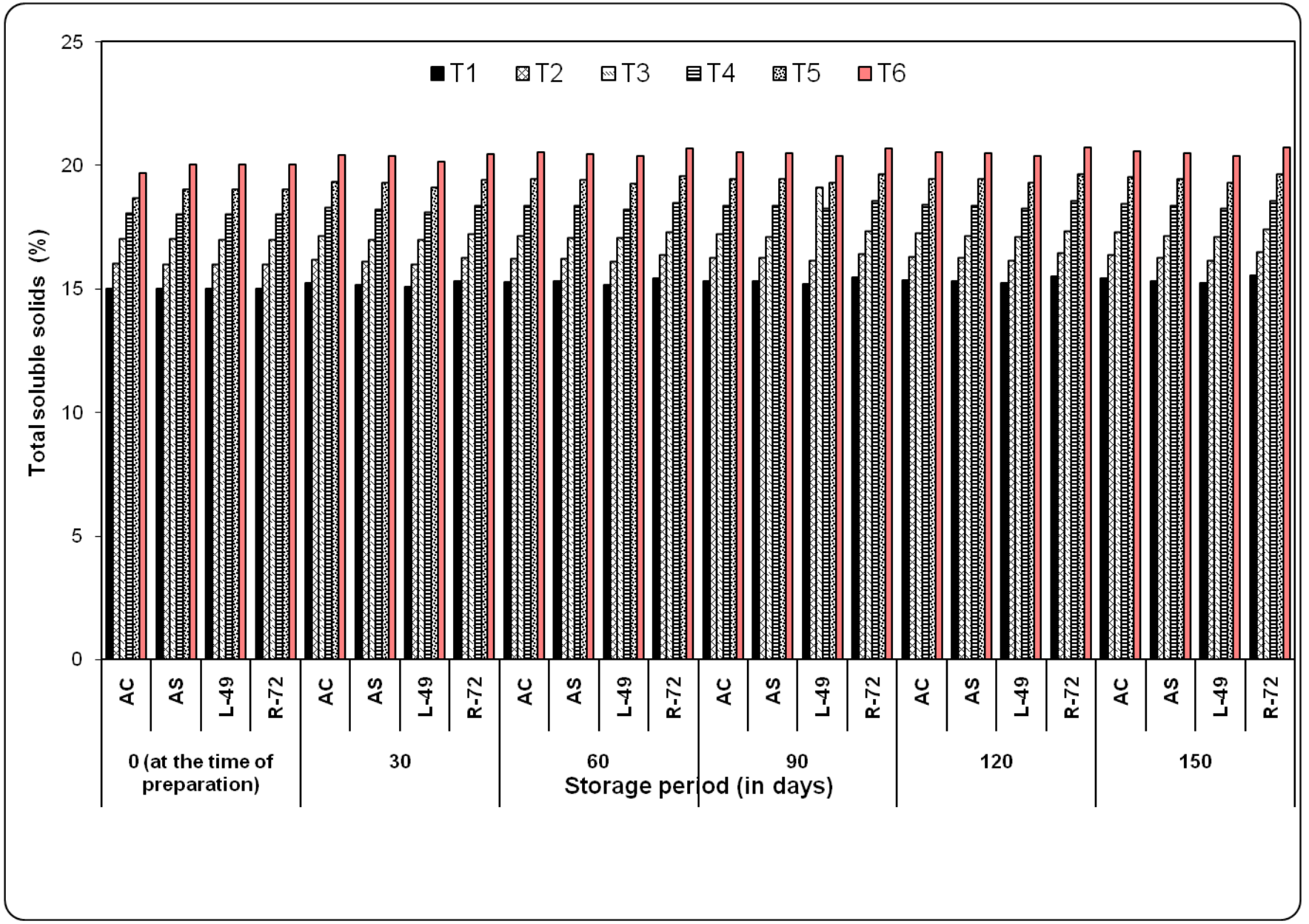
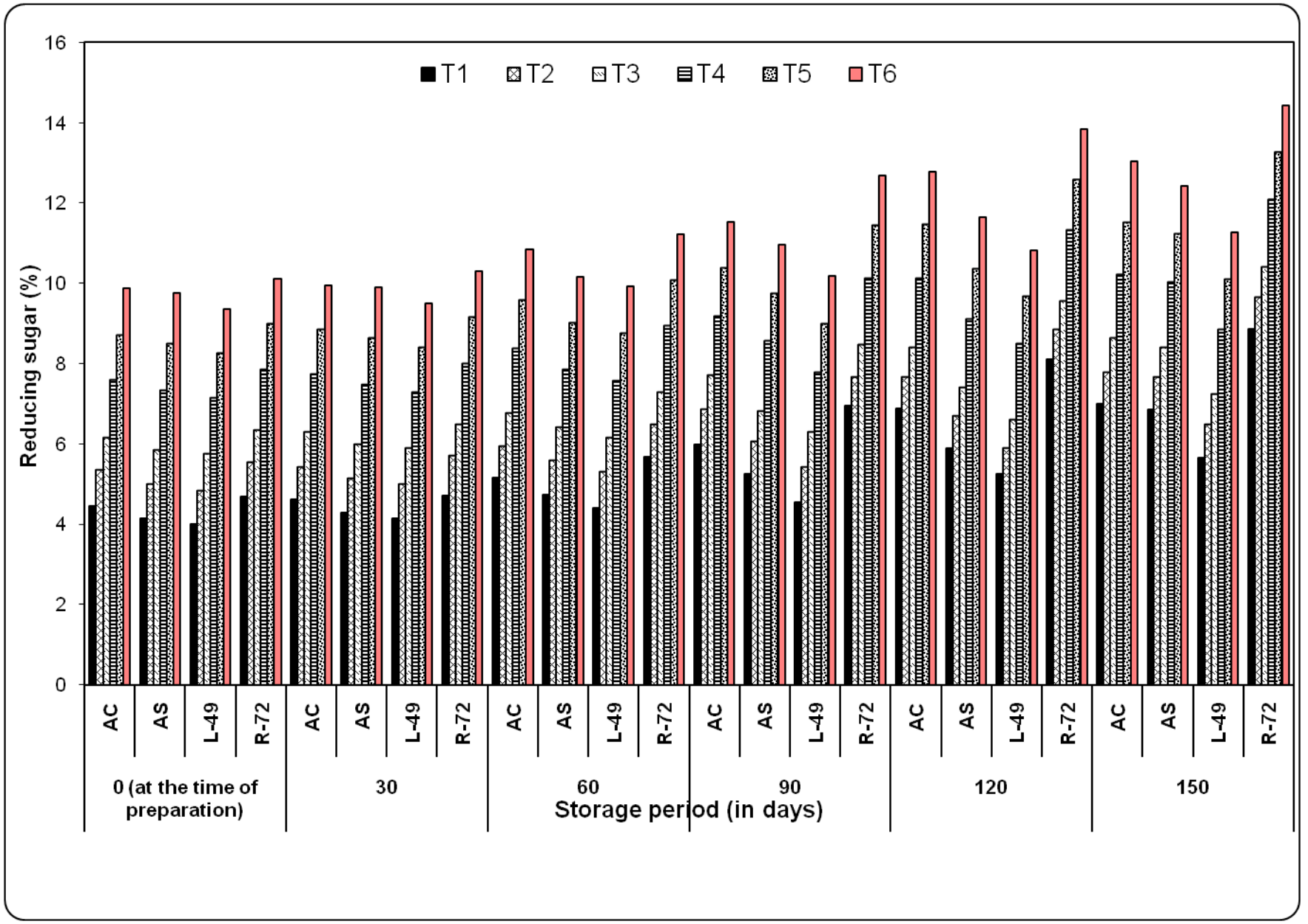
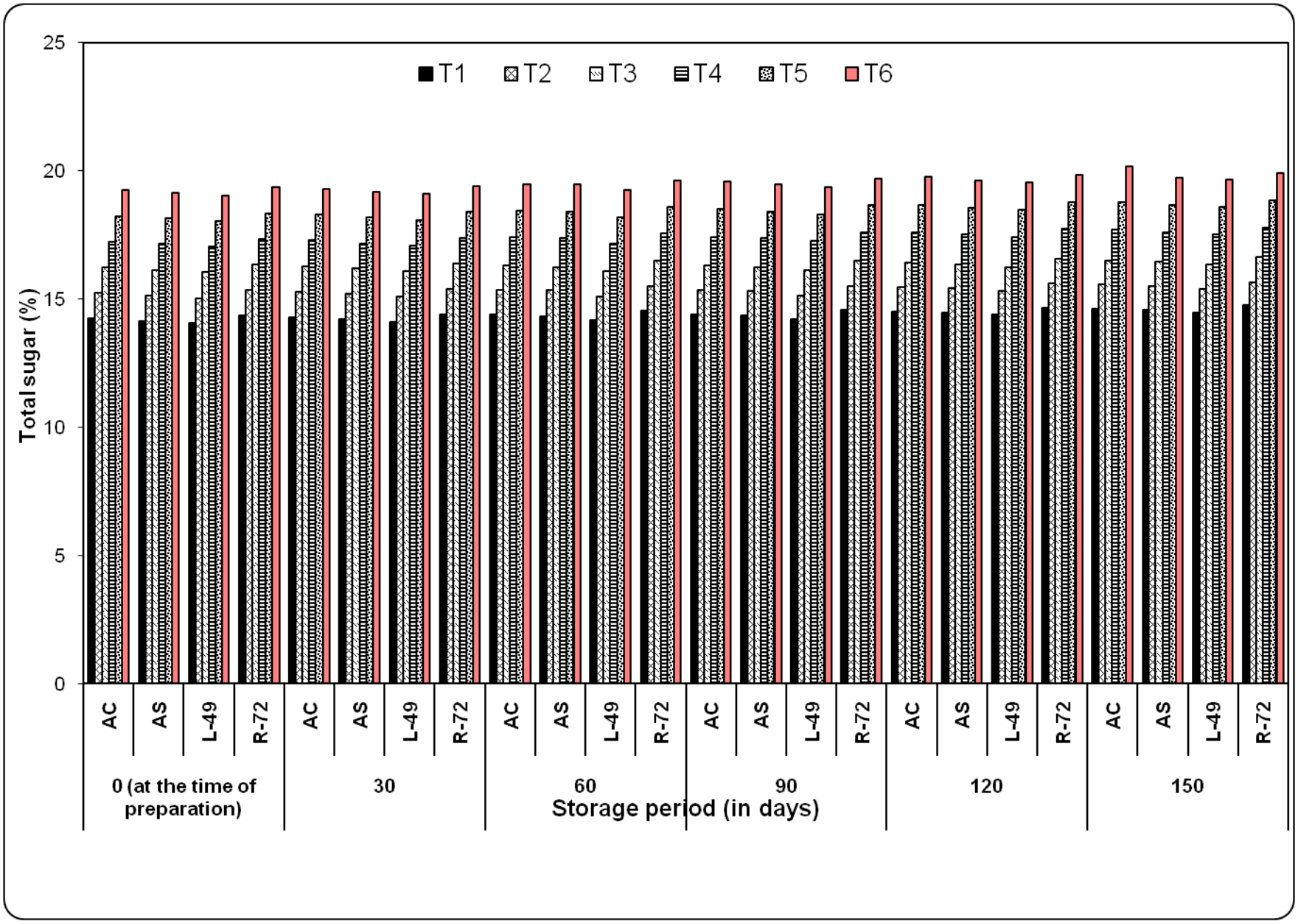
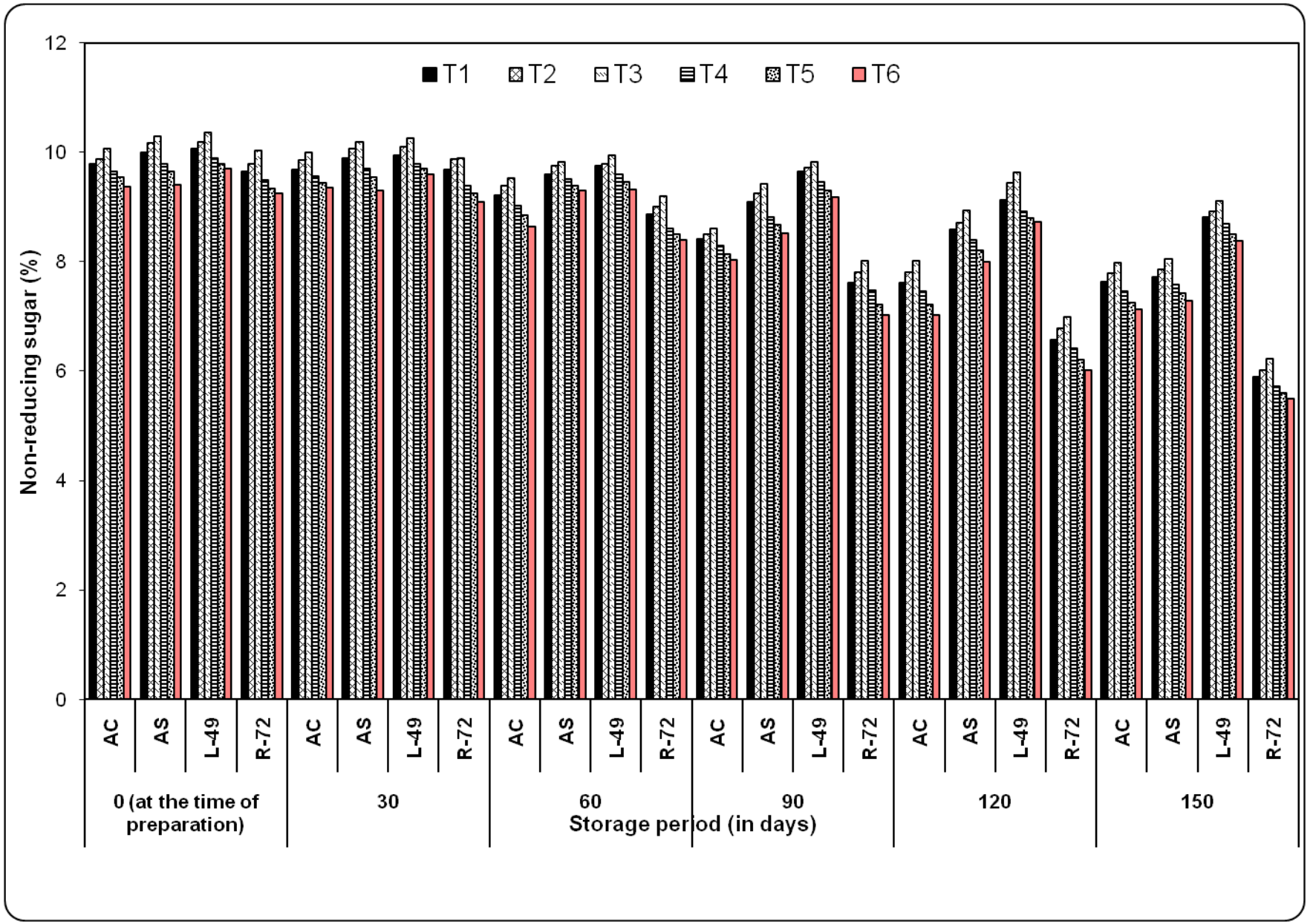


Fig. 4.3 : Changes in the pH due to cultivars and recipe treatments in stored guava nectar


T1
T2
T3
T4
T5
T6
Total soluble solids (%)
25
20
15
10
5
0
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)


T1
T2
T3
T4
T5
T6
Reducing sugar (%)
16
14
12
10
8
6
4
2
0
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)


T1
T2
T3
T4
T5
T6
Total sugar (%)
25
20
15
10
5
0
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)


T1
T2
T3
T4
T5
T6
Non-reducing sugar (%)
12
10
8
6
4
2
0
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)

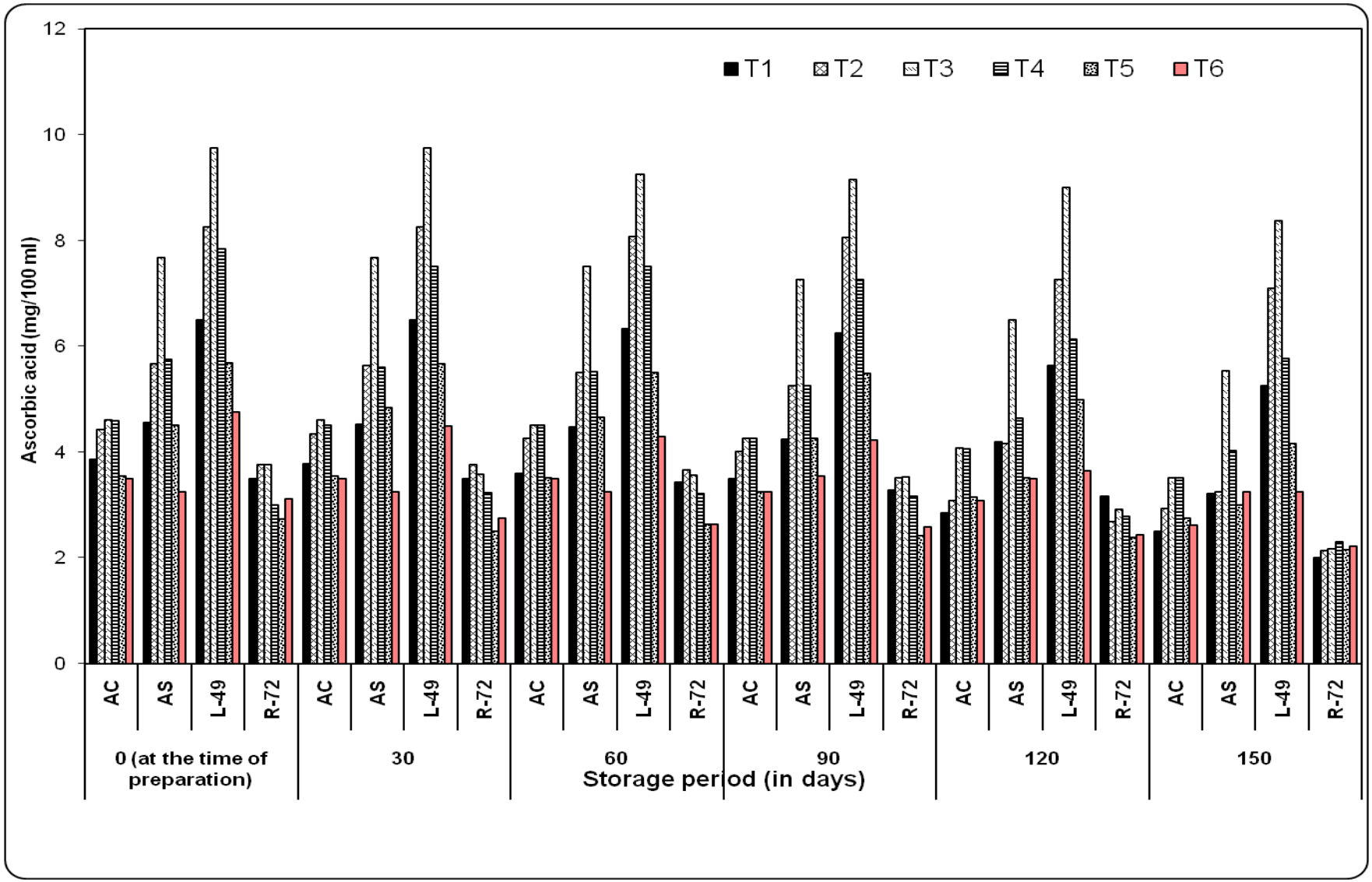
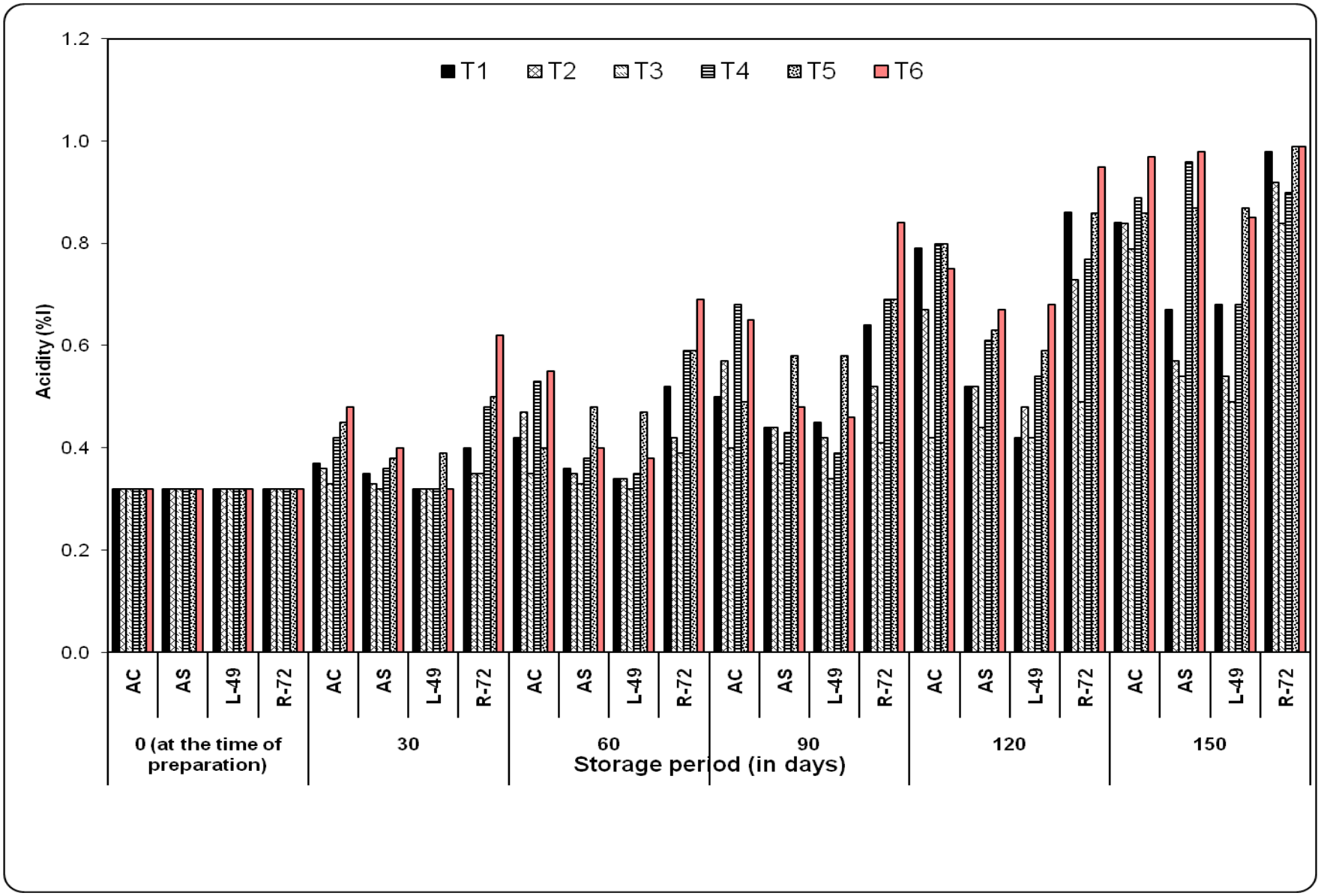
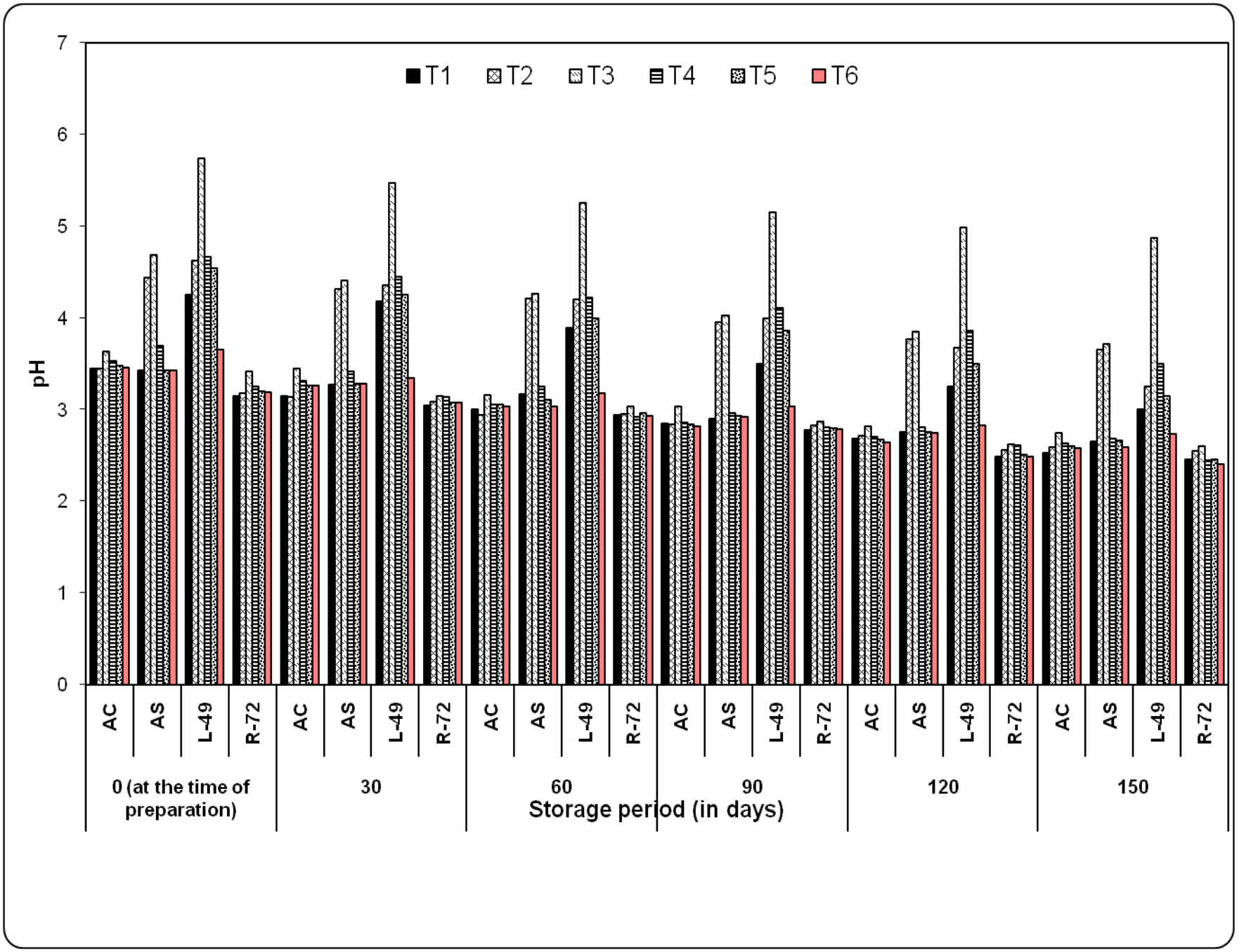
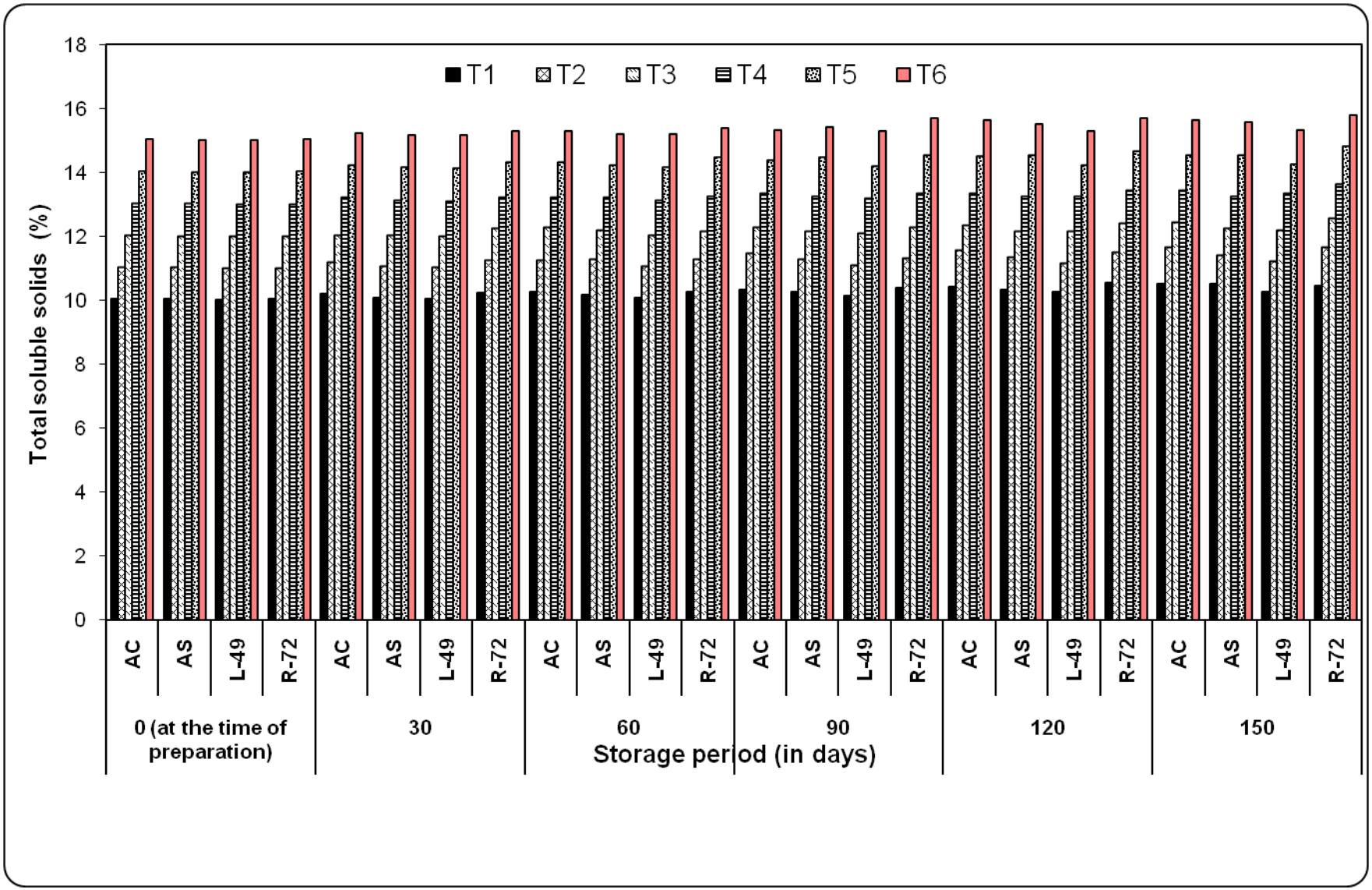
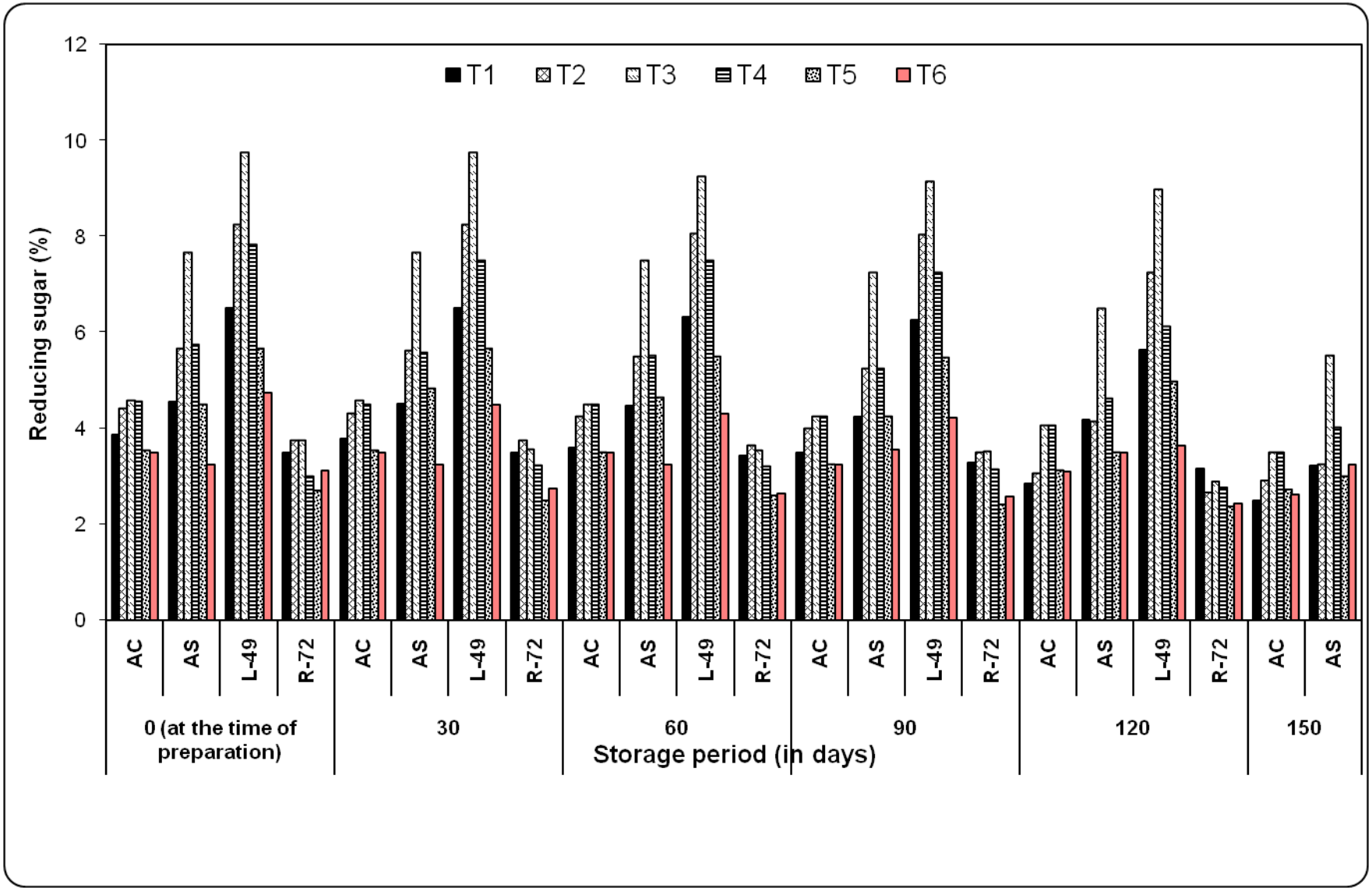


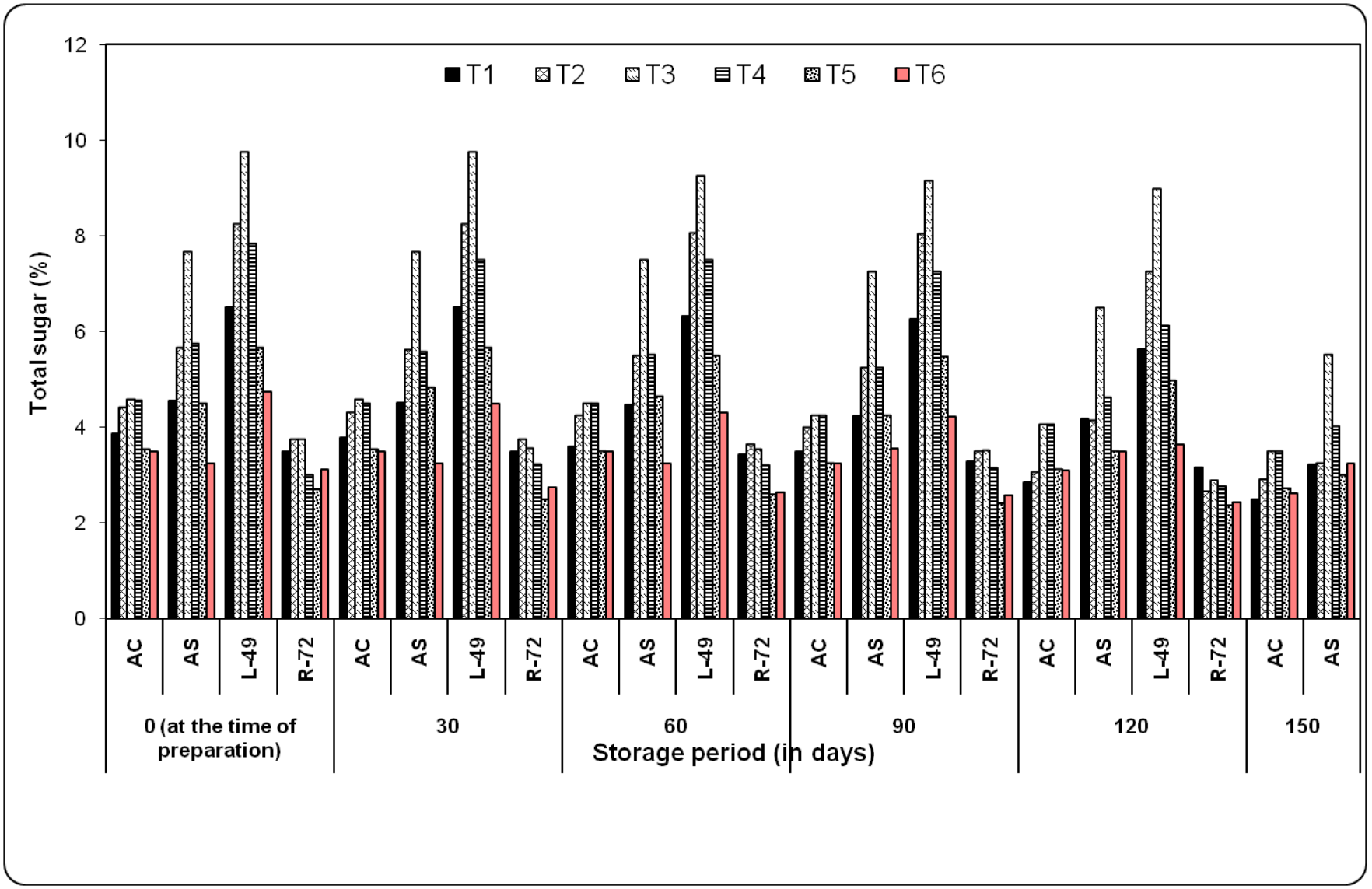
Fig. 4.9 : Changes in ascorbic acid (mg/ 100 ml) due to cultivars and recipe treatments in stored guava RTS

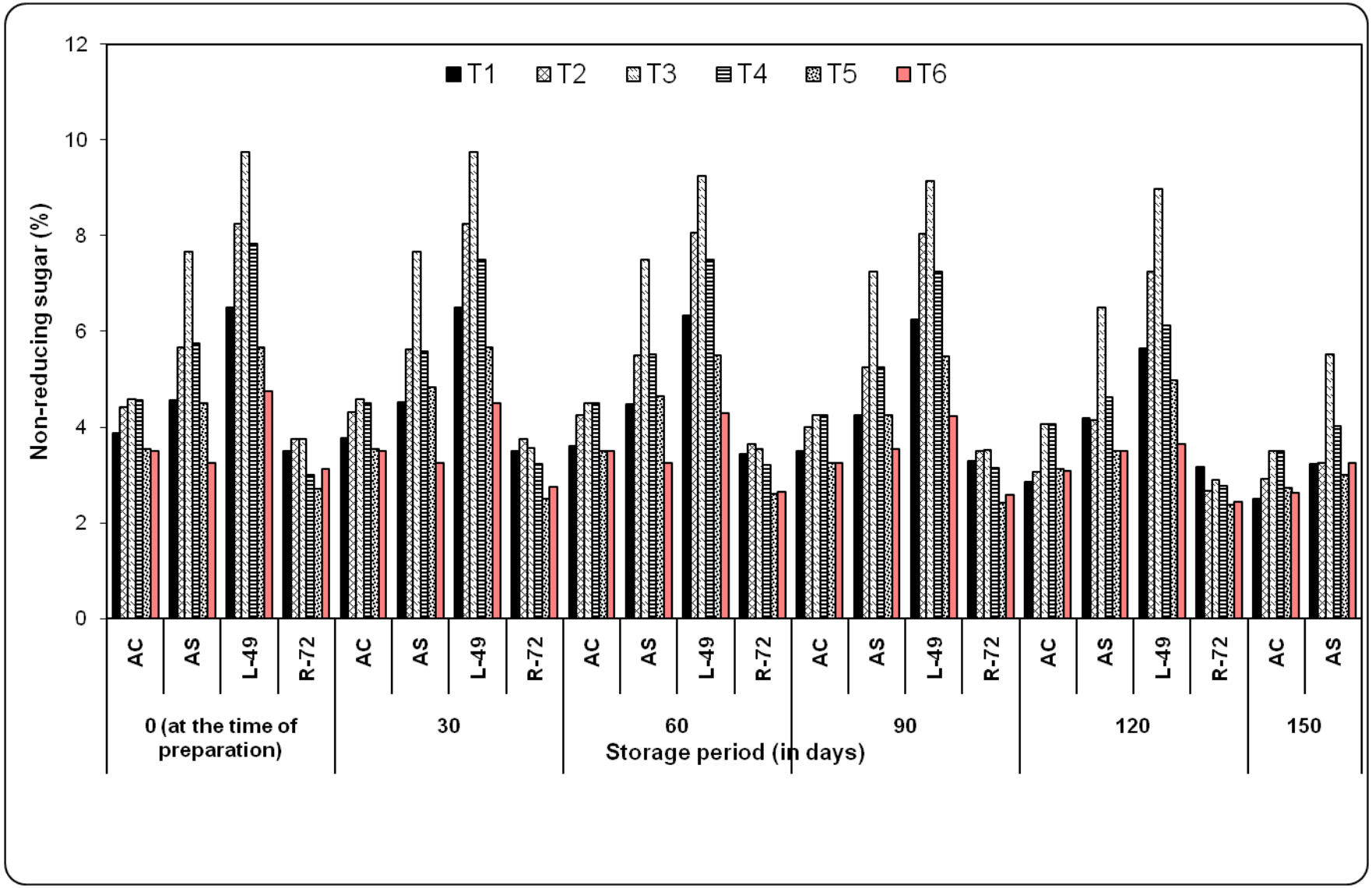

T1
T2
T3
T4
T5
T6
Acidity (%l)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)

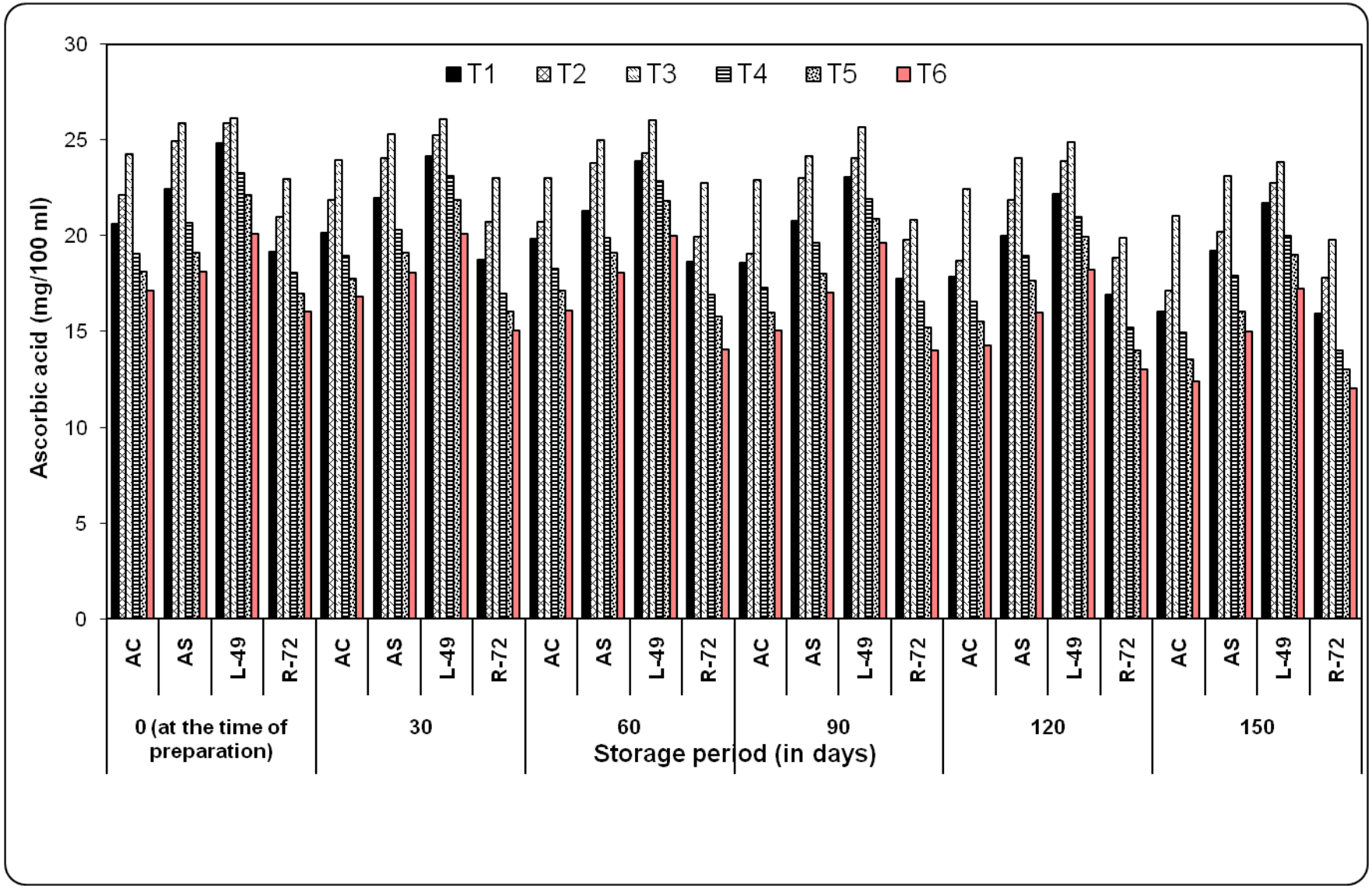

T1
T2
T3
T4
T5
T6
pH
0
1
2
3
4
5
6
7
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)


T1
T2
T3
T4
T5
T6
Total soluble solids (%)
0
2
4
6
8
10
12
14
16
18
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)


T1
T2
T3
T4
T5
T6
Reducing sugar (%)
12
10
8
6
4
2
0
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)


T1
T2
T3
T4
T5
T6
Total sugar (%)
12
10
8
6
4
2
0
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)


T1
T2
T3
T4
T5
T6
Non-reducing sugar (%)
12
10
8
6
4
2
0
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)


T1
T2
T3
T4
T5
T6
Ascorbic acid (mg/100 ml)
30
25
20
15
10
5
0
AC
AS
L-49
R-72
0 (at the time of preparation)
30
60
90
120
150
Storage period (in days)