Effect of Pre-harvest Spray of GA_3, Calcium Nitrate and Potassium Sulphate on Post-harvest Behaviour of Guava (*Psidium guajava* L.) Fruits of Cultivars Dharidar and Chittidar

THESIS

Submitted to the

Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya

In partial fulfilment of the requirement for the Degree of

DOCTOR OF PHILOSOPHY

In

HORTICULTURE

(FRUIT SCIENCE)

By

ROOP NARAYAN KANPURE

Department of Horticulture

Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya

College of Agriculture, Gwalior (MP)

2019

CERTIFICATE - I

This is to certify that the thesis entitled ***Effect of Pre-harvest Spray of GA_3, Calcium Nitrate and Potassium Sulphate on Post-harvest Behaviour of Guava (Psidium guajava* L.*) fruits of Cultivars Dharidar and Chittidar*** *Submitted in partial fulfillment of the requirements for the degree of* ***DOCTOR OF PHILOSOPHY in HORTICULTURE - FRUIT SCIENCE*** *of Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya Gwalior is a record of the bona-fide research work carried out by* ***Mr. Roop Narayan Kanpure*** *under our guidance and supervision. The subject of the thesis has been approved by the Student's Advisory Committee and Director of instruction.*

No part of the thesis has been submitted for any other degree or diploma. All the assistance and help received during the course of this investigation has been duly acknowledged by the scholar.

(Rajesh Tiwari)
Chairman of the Advisory Committee

MEMBER OF STUDENT'S ADVISORY COMMITTEE

Chairman: Dr. Rajesh Tiwari……

Co-Chairman: Dr. S. S. Kushwah ……..

Member: Dr. A. K. Barholia……..

Member: Dr. S.N. Mishra ……

Member: Dr. G. P. S. Rathore …….

CERTIFICATE – II

This is to certify that thesis the entitled ***Effect of Pre-harvest Spray of GA_3, Calcium Nitrate and Potassium Sulphate on Post-harvest Behaviour of Guava (Psidium guajava* L.*) fruits of Cultivars Dharidar and Chittidar*** *Submitted by* ***Mr. Roop Narayan Kanpure*** *to the* ***Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior*** *in partial fulfillment of the requirements for the degree of* ***Ph. D. in HORTICULTURE - FRUIT SCIENCE*** *to the* ***Department of Horticulture*** *has been accepted after evaluation by the External Examiner and by the Student's Advisory Committee after an oral examination of the same.*

Place: Gwalior

Date: ……. (……)

External Examiner

MEMBERS OF THE ADVISORY COMMITTEE

Chairman: Dr. Rajesh Tiwari**……..**

Co-Chairman: Dr. S. S. Kushwah **…… …**

Member: Dr. A. K. Barholia**……**

Member: Dr. S.N. Mishra **…….**

Member: Dr. G. P. S. Rathore **…….**

Head of the Department …… ..……..……

Dean of the College……..……..……

Director of Instruction ……...……..……

ACKNOWLEDGEMENT

*First and foremost, I would like to thank **God** Almighty for giving me the strength, knowledge, ability and opportunity to undertake this research study and to persevere and complete it satisfactorily. Without his blessings, this achievement would not have been possible. I gratefully acknowledge my University RVSKVV, Gwalior (M.P.) who provides an opportunity to undertake my Ph.D. as In-service candidate. My special thanks to my thesis chairman Dr. R. Tiwari, Professor RVSKVV Gwalior who encouraged and directed me. I would also like to thank my co- chairman and members of my advisory committee Dr. S.S. Kushwah, Assistant Professor Department of Vegetable Science College of Horticulture Mandsaur, Dr. A. K. Barholia, Professor RVSKVV Gwalior, Dr. S.N. Mishra, Professor Department of Soil Science and Agril. Chemistry and Dr. G.P.S. Rathore, Department of Statistics and Computer Science College of Horticulture Mandsaur.*

I am very thankful to Dr. Rajesh Lekhi, Professor (Fruit Science) and Head Department of Horticulture, RVSKVV, Gwalior (M.P.) for his valuable advisements and welcoming thoughts in my experiment.

With profound respect I am extremely thankful to Dr. S.K. Rao, Honourable Vice Chancellor, RVSKVV, Gwalior, Dr. A. K. Singh, Director of Instruction and Dr. Mridula Billore, Dean, Faculty of Agriculture, Dr. B.S. Baghel, Director Research Services R.V.S.K.V.V., Gwalior, (MP). With deepest sense of humility and gratefulness, I feel myself duly bound to express my heartfelt and sincere thanks to Dr. M.P. Jain, Dean College of Agriculture, Gwalior, and Dr. S.N. Mishra Dean College of Horticulture Mandsaur for providing necessary facilities and guidance in completing the present investigation.

I am also thankful to Dr. K. N. Nagaich, Professor, Dr. K. S. Tomar, Professor and Dr. H.P. Singh Professor RVSKVV for their suggestions and moral support during the course of my investigation.

I am also thankful to my colleagues Dr. Basant Kachouli, Dr. K.K. Yadav, Dr. Lal Singh, Dr. Praveen Gurjar, Dr. Manoj Kureel and Dhan Singh Mandloi.

I also appreciate the co-operation and encouragement of my lovely Juniors Dr. Ajay Haldar and Jitendra Bhandari and Dr. K.C. Meena and Dharmendra Patidar College of Horticulture Mandsaur.

My acknowledgement would be incomplete without thanking the biggest source of my strength, my family.

Place: **Gwalior**

Date: (**Roop Narayan Kanpure**)

Contents

List of Table

List of Figures

List of Plates

List of symbol

Symbol	Abbreviation	Stand for
%	-	Percentage
&	-	and
/	-	Per
@	-	At the rate of
-	ANOVA	Analysis of variance
-	B:C	Benefit cost ratio
-	C.D.	Critical difference
-	cm	Centi meter
-	^{o}C	Degree Celsius
-	^{o}B	Degree Brix
-	B	Beta
-	Cv.	Cultivar
-	Cal	Calorie
-	d.f.	Degree of Freedom
-	*et al.*	And others/ associates
-	etc.	etcetera
-	Fig.	Figure
-	g	gram
-	ha.	hectare
-	i.e.	That is
-	Kg	Kilogram
-	Kg/ha.	Kilogram per hectare
-	M.P.	Madhya Pradesh
-	M.S.S.	Mean sum of square
-	mg	Milligram
-	Max.	Maximum
-	Min.	Minimum
-	No.	Number
-	NS	Non-significant
-	NHB	National Horticultural Board

-	Nm	Nanometer
-	PLW	Physiological loss in weight
-	ppm	Part per million
-	R.H.	Relative humidity
-	□	Rupees
-	RBD	Randomized Block Design
-	S.Em.	Standard Error of Mean
-	Sig.	Significant
-	viz.	(videlicet) Namely

Chapter- I

INTRODUCTION

Guava (*Psidium guajava* L.) is an important fruit crop of India. Due to hardy nature of plant it can withstand adverse climatic conditions and grows under a wide range of soil types from sandy to clay loam (Dhaliwal and Singla, 2002). It is normally consumed fresh as a dessert fruit or processed into juice, concentrate, jam, jelly, nector or syrup (Jagtiani *et al.,* 1988). There is an increasing demand of fruits for fresh as well as processing purpose in domestic and international markets. Guava fruits are normally consumed as fresh or processed into several products like jam, jelly, cheese, nectar, paste preparation etc. (Boora, 2012).

Guava (*Psidium guajava* L.) is one of the most well known fruit crop grown widely in more than sixty countries throughout the tropical and sub-tropical regions in the world. In India, it occupies an area of 0.26 million hectares with annual production of 3.66 million tonnes (NHB, 2014). The fruits are delicious, rich in vitamin 'C', pectin and minerals like calcium, phosphorous and iron.

There is a great demand of guava fruits in both domestic and international markets for fresh and processing purposes. The share of guava in fresh fruit export from India is mere 0.65 per cent, which can be further boosted, if fruit is properly handled after harvest to earn more foreign exchange (Mitra *et al*., 2008).

Guava is a member of Myrtaceae family, sometimes known as "Super fruit" because it is embedded with immense nutritive values which have several health benefits. However, large quantity of fruit is lost after harvest due to inherent bio-chemical changes. In recent years, plant growth regulators have been used for improving the quality, delaying deterioration in storage and thereby increasing shelf-life of various fruit crops including guava. Some chemicals like calcium, potassium and plant growth regulator have been reported to prolong shelf-life and improve the quality by affecting the wide range of physiological

processes in plants and also inhibit specific aspects of abnormal senescence in numerous fruits (Farag and Kassem, 2000).

Calcium compounds extend the shelf-life of several fruit by maintaining firmness, minimizing the rate of respiration, protein breakdown and disease incidence (Gupta *et al.*, 1980). Calcium compounds have shown promise in the quality retention of fruit also (Huber, 1983). The choice of different calcium compounds to supply the required calcium is quite confusing, due to mixed report from scientific community about the superiority of one calcium compound on the other.

GA_3 is the most effective chemical for increasing the weight, specific gravity and decreasing the total acid content in guava fruits (Kher *et al*., 2005). Brahmachari and Rani (2005) suggested that GA_3 and kinetin are beneficial in prolonging the shelf-life and retaining the quality of guava fruits.

Potassium is a unique mineral element in plant biology. It has a pertinent role in many metabolic processes, like carbohydrate synthesis and development of meristematic tissues, as well as encourages lignifications and regulates water absorption and transpiration. Also, it plays an active role in cellular protein metabolism. Appearance fruit quality factors are very important from the marketing point of view to fetch higher price. It includes size, shape, colour, gloss and freedom from defects and decay (Mitra *et al*., 2009).

Under ambient conditions, fruits become overripe and mealy within a week, whereas, in cold storage guava cv. Allahabad Safeda fruits maintained quality up to 15 days at 8-10ºC and 85-90% RH (Tandon *et al.*, 1989). Therefore, it needs immediate marketing and utilization after harvesting.

Guava is a perishable fruit and highly prone to bruising and mechanical injuries. Due to such perishability, control of fruit ripening is fundamental and this generates the necessity to search for new technologies to increase shelf-life, reach distant markets and thus improve the marketing process (Mitra *et al*., 2012). Peel colour is the best maturity index in guava (Mercado-Silva *et al*., 1998; Kader, 1999 and Asrey *et al*., 2008). Fruits attaining maturity show signs of changing colour from pale green to yellowish-green. If the fruit is to

be shipped to distant markets, it should be mature, full sized and of firm texture, but without an obvious colour break on the surface. Fruits for local market can be harvested in a more advanced stage of maturity (Singh, 2007). However, harvesting fruits at appropriate stage of maturity is critical in maintaining the post harvest quality of guava fruits (Azzolini *et al*., 2004 and Patel *et al*., 2015). Storage under low temperatures considered the most efficient method to maintain quality of most fruits and vegetables due to its effects on reducing respiration rate, transpiration, ethylene production, ripening, senescence and disease incidence. On the other hand, enzymatic reactions occur slowly at low temperatures, extending shelf-life of perishables (Bron *et al*., 2005). In climacteric fruits, like most guava varieties, the reduction of temperature delays the climacteric peak and consequently, ripening process (Paull and Chen, 2002).

Keeping the above facts in view therefore , an experiment to study the effect of pre-harvest spray of gibberellic acid, calcium nitrate and potassium sulphate on post-harvest behaviour of guava fruits of cultivars Dharidar and Chittidar was conducted in the Department of Fruit Science, College of Horticulture, Mandsaur with following specific objectives: -

(1) To find out the independent effects of GA_3, Calcium nitrate ($Ca(NO_3)_2$) and Potassium sulphate (K_2SO_4) on shelf-life, physio-chemical characters and organoleptic values of guava fruits.

(2) To find out the combined effects of GA_3, Calcium nitrate ($Ca(NO_3)_2$) and Potassium sulphate (K_2SO_4) on shelf-life, physio-chemical characters and organoleptic values of guava fruits.

(3) To assesses the best treatment for shelf-life, physio-chemical characters and organoleptic values of guava fruits.

(4) To work out the economic feasibility of the treatments.

Chapter- II

REVIEWS OF LITERATURE

Lots of work has been done by different workers in India and abroad on pre- harvest treatments of guava in relation to extending the shelf-life of fruits. The present chapter deals with the review of work carried out by the various researchers.

In this chapter, an attempt has been made to review the research work done so far in India and abroad by different workers on the effect of pre-harvest spray of gibberellic acid, calcium nitrate and potassium sulphate on post harvest behaviour of different guava cultivars.

Effect of gibberellic acid on post-harvest behaviour of guava fruits

Singh (1998) studied that the calcium nitrate, NAA and GA_3 on the storage life of Allahabad Safeda guava. Lower concentration of calcium nitrate (1%) and higher concentration of NAA (100 ppm) and GA_3 (40 ppm) were effective in minimizing the loss in weight, reduced the rate of respiration, rot percentage and finally maintained the edible quality and marketability of fruits for more than 6 days by delaying the onset of senescence during storage. However, 1 per cent calcium nitrate was always found more effective than NAA and GA_3. Treatment with 1 per cent calcium nitrate + 100 ppm NAA showed beneficial effects in prolonging the storage-life of fruits as compared to remaining combinational treatments. The untreated fruits remained in acceptable conditions only for 3 day.

Aly and Ismail (2000) sprayed the Balady guava trees at the end of September with 150 ppm GA_3, 0.5% $CaCl_2$ or 0.4% B (borax). The fruits were harvested in the last week of October and stored at room temperature for 14 days. The results in both seasons of study revealed that guava fruits harvested from trees treated with either GA_3 or $CaCl_2$ were firmer and had higher percentages of acid, total soluble solids, ascorbic acid (mg/100 ml juice) and insoluble pectin contents than the control fruits or boron treated ones. On the other hand, spray treatments with $CaCl_2$ or GA_3 decreased fruit skin browning and polyphenol oxidase (catechol oxidase) (PPO) activity compared with the control and boron treated fruits, which showed the highest browning areas and PPO activity.

Farag and Kassem (2000) studied the effect of different sources of phosphorus, potassium and calcium alone or in combinations on 'Manshiya' clone guava during two successive seasons 1995 and 1996. Napthalene acetic acid (NAA) application either alone or in combination with the three minerals was investigated. The combination of $CaCl_2$ plus each of the potassium phosphate, calcium phosphate and NAA caused a significant increase in fruit weight as compared with the control. Fruit firmness at harvest was significantly increased by $CaCl_2$ alone or in combination with NAA during both seasons. $CaCl_2$ in addition to either calcium phosphate or potassium phosphate resulted in higher fruit firmness after 7 days of shelf-life as compared with the control.

Sudha *et al.* (2007) revealed that pre harvest spray of 50 ppm GA_3 with post harvest dipping of GA_3 50 ppm along with 0.2% carbendazim recorded the lowest physiological loss of weight, shrinkage percentage, and increased shelf-life and reduced spoilage. The pre harvest spray of 50 ppm GA_3 with post harvest dipping of $CaCl_2$ 1% along with 0.2% carbendazim recorded highest firmness.

Lal *et al.* (2011) concluded an experiment on pre-harvest foliar application in apricot cv. Harcot with $CaCl_2$ @ 1.5% at three stages, i.e., 80% blooming, at fruit-set and 15 days before harvest, enhances shelf-life of the fruit from 3-5 days storage to 8 days storage, and can maintain good fruit quality under ambient storage-conditions for up to 8 days.

Kirmani *et al.* (2013) studied the effect of pre-harvest application of various chemicals on physical changes that occur during storage and to prolong the shelf-life of plum under ambient storage conditions. Fruit size, weight and firmness recorded continuous decrease with the advancement of storage period. However, 0.5% calcium chloride ($CaCl_2$) proved to be more efficacious in minimizing these losses. Maximum increase in fruit size and weight at the time of harvest was recorded with the pre-harvest application of 60 ppm NAA. Physiological loss in weight (PLW) and microbial spoilage followed continuously increasing trend with the advancement of storage period. Among the various pre-harvest treatments, 0.5% $CaCl_2$ applied 20 and 10 days before the expected date of harvest proved to be the most effective treatment in retaining the fruit quality during the entire storage period. Such

fruits exhibited minimum loss in weight, maximum retention in firmness and minimum spoilage on each sampling date. In general, overall acceptability of fruits decreased with the passage of storage time. However, fruits treated with $CaCl_2$ were rated as most acceptable and was followed by gibberellic acid (GA_3) treatment at the end of storage period under ambient conditions.

Yadav and Varu (2013**)** assessed the pre-harvest spray of GA_3 15 ppm + carbendazim 0.05% and post-harvest dip in $CaCl_2$ 1% individually as well as their combination (GA_3 15 ppm + carbendazin @ 0.05% and $CaCl_2$ @ 1% and were found to be more effective in reducing physiological loss in weight, the highest percentage of marketable fruit, lowest percentage of ripened fruit, lowest days to start ripening and highest shelf-life of papaya cv. Madhubindu. Similarly for biochemical parameters and organoleptic score, highest TSS, lowest acidity, highest ascorbic acid, total sugars, vitamin A and fungal intensity as well as organoleptic parameters like colour, texture, taste, flavor and overall acceptability were also found better in GA_3 @ 15 ppm + carbendazim 0.05% as pre-harvest spray and $CaCl_2$ 1% as post-harvest dip. The interaction effect was also found significant and better performance was observed in treatment combination GA_3 @ 15 ppm + carbendazim and $CaCl_2$ 1%.

Chouhal *et al.* (2015) carried out an investigation at Saharanpur (U.P.) with an aim to improve the quality and shelf-life of mango. The treatments comprised of mulching, borax @ 0.5 and 1.0 per cent, potassium sulphate @ 0.5 and 1.0 per cent, calcium chloride @ 0.5 and 1.0 per cent, calcium nitrate @ 0.5 and 1.0 per cent, GA_3 @ 25 and 50 ppm, NAA @ 25 and 50 ppm in combination with mulching and water spray without mulching as control. The spray was done three times at different times at different stages during the year 2010 and 2011. First spray on 15th January (*i.e.* before flower bud burst), IInd spray on 15th February (i.e. at panicle emergence) and IIIrd spray on 15th April (i.e. after fruit set). It was concluded that the application of $Ca(NO_3)_2$ improved flowering parameters, increased the number of fruits and fruit yield and K_2SO_4 increased the physical characteristics of fruit.

Patel *et al.* (2015) sprayed mango trees with 2, 4-D 20 ppm + $ZnSO_4$ 0.05 per cent which showed good results for fruit yield and yield attributing traits as well as shelf-life of fruits. Whereas, physical parameters like highest

marketable fruit, minimum spoiled fruit, minimum rippened fruit as well as lowest days for ripening were recorded in pre-harvest spray of GA_3 25 ppm + borax 1 per cent. The quality parameters like TSS, acidity, ascorbic acid, vitamin- 'A', colour, flavour, texture, taste and overall acceptability etc. were performed better in pre harvest spray of GA_3 25 ppm + $ZnSO_4$ 0.05 per cent and GA_3 25 ppm + $CaCl_2$ 2 per cent.

Rokaya *et al*. (2016) evaluated the effect of gibberellic acid on fruit quality and shelf life of the mandarin fruits. Observations on fruit weight (g), fruit firmness (kg/cm^2), rind colour (1 - 5 index), juice recovery (%), TSS/acid ratio, PLW (%), decay loss (%), and ascorbic acid (mg/100 ml) were recorded at three harvesting dates of mandarin, i.e. 20 Nov, 5 Dec, and 20 Dec and storage conditions. It has been revealed that the fruits treated with GA_3 at 20 ppm retained higher fruit weight (128.6 g), better firmness (3.54 kg/cm^2), higher juice recovery (57.75%), and greater TSS/acid ratio (21.24) at the end of study (20 December). The PLW was found less with GA_3 at 30 ppm in both ambient (5.17%) and cellar (6.69%) conditions as against untreated fruits (9.52 and 11.76%). Similarly, the decay loss was minimum in the fruits treated with GA_3 at 30 ppm both with ambient (1.02%) and cellar condition (8.21%) as against control with ambient (5.54%) and cellar (21.58%).

Desai *et al.* (2017) examined the influence of pre-harvest spraying treatments of chemicals and plant growth regulators on physical parameters, post-harvest losses and shelf-life of sapota fruits cv. Kalipatti. Pre-harvest spraying treatments comprising different chemicals (calcium chloride @ 2%, calcium nitrate @ 2%, calcium sulphate @ 2% and potassium chloride @ 2%) and different level of plant growth regulators (GA_3 @ 50 and 100 mg / l, NAA @ 50 and 100 mg / l) with control (water spray and absolute). After harvest the fruits were stored at room temperature. Fruit weight and fruit volume were significantly increased when trees were sprayed with GA_3 @ 100 mg / l one month before harvest. However, minimum physiological loss in weight and spoilage percentage were noticed under $CaCl_2$ @ 2% treatment followed by treatment $Ca(NO_3)_2$ @ 2%. These treatments also improve the fruit firmness, shelf-life and day taken to ripening of the sapota fruits during storage.

Effect of gibberellic acid and calcium nitrate on post-harvest behaviour of guava fruits

Rajkumar *et al.* (2005) conducted an experiment in order to examine the efficacy of four levels each of $CaCl_2$, $Ca(NO_3)_2$ (1, 2, 3 and 4% each) and GA_3 (50, 100, 150, and 200 ppm) on the post-harvest behaviour of papaya fruits. Uniformed size fruits were harvested at the physiological maturity and dipped in various treatments for 5 min. at room temperature. Post-harvest treatments of papaya fruits in GA_3 @ 100 ppm and $CaCl_2$ @ 2% recorded significantly the lowest loss in fruit weight, ripening percentage and decay rate and but which high firmness, high TSS, high ascorbic acid content, titrable acidity and also higher score for sensory evaluation. The study suggests that both GA_3 @ 100 ppm and $CaCl_2$ at 2% as post-harvest dip could preserve the physiological changes and improve the shelf-life up to nine days and the fruit quality in papaya.

Selvan and Bal (2005) examined the effects of GA_3 (25, 50 and 75 ppm), NAA (25, 50 and 75 ppm), calcium nitrate (0.5 and 1%) and/or benlate (500 and 1000 ppm) on the shelf-life of guava cv. Sardar. Application of calcium nitrate at 0.5 and 1% resulted in the highest mean total soluble solid content (11.50%) and lowest mean spoilage (10.16%), respectively. Mean acidity and vitamin - C content were highest with the application of 500 ppm Benlate, whereas the mean sensory score was highest with the application of 1% calcium nitrate.

Jawandha *et al.* (2008) conducted an experiment to study the effect of post-harvest sprays of $CaCl_2$ (@ 0.5, 1.0 & 2.0%), $Ca(NO_3)_2$ (@ 0.5, 1.0 & 2.0%), GA_3 (@ 20, 40 and 60 ppm) and carendazim (0.1%) on storage quality of 'Umran' ber'. Fruits of uniform size were harvested at physiological maturity and treated with various chemicals. Treated fruits were placed in CFB boxes and placed in cold storage (3-5°C and 85-95% RH). Stored fruits were evaluated at 10, 20 and 30 days from storage for palatability rating, TSS, acidity, Vitamin C and total sugars. After 30 days from storage, the highest palatability rating was recorded in GA_3 (60 ppm) treated fruits, followed by $CaCl_2$ (2.0%). Both TSS and total sugars showed a similar trend of increase up to 20 days from storage, followed by a decrease. However, acidity and Vitamin C content of fruits decreased continuously with advancement of

storage period. At the end of storage, maximum TSS, total acidity Vitamin C and total sugars were observed in GA_3 (60 ppm) treated fruits, followed by $CaCl_2$ (2.0%). Studies revealed that GA_3 (60 ppm) treated ber fruits maintained very good quality at 20 days of cold storage.

Mahajan *et al*. (2008) treated the plum cv. Satluj Purple with GA_3 (20, 30 or 40 ppm) or $Ca(NO_3)_2$ (0.5, 1.0 or 2.0%) for 5 minutes, then stored for 4 weeks in corrugated fibre board cartons at 0-10^{0}C and 90-95% relative humidity. and noticed in firmness during the storage was delayed by $Ca(NO_3)_2$. Fruits treated with 2% $Ca(NO_3)_2$ were the most firm throughout 7-28 days of storage and showed the lowest physiological weight loss (0.60-2.88%) after 7-28 days. Fruits treated with 2% $Ca(NO_3)_2$ did not exhibit spoilage until 3 week of storage. Treatments with 2% $Ca(NO_3)_2$ resulted in the highest organoleptic score (8.47). Fruits treated with 2% $Ca(NO_3)_2$ maintained desirable firmness, minimum weight loss, acceptable organoleptic rating, and quality for 2 days.

Sen *et al.* (2012) carried out study for two years was aimed at determining the effect of pre-harvest gibberellic acid (GA_3) and calcium applications on on-tree storage of Satsuma fruit. Gibberellic acid (GA_3, 10 ppm) and Ca ($CaCl_2.2H_2O$, 2%), their combined application and GA_3 application repeated twice were tested on Satsuma mandarin (*Citrus unshiu* Mar. 'Owari') budded onto trifoliate orange rootstock. GA_3 was applied two weeks before the colour break and at colour break, whereas Ca was applied at colour break stage. Control trees were sprayed with surfactant added water. The first harvest was performed at the usual harvest period for the region, and additional two harvests were made at monthly intervals. At each harvest, fruit samples were analyzed for specific gravity peel colour, chemical composition of fruit juice and electrolytic leakage of peel. Starting from the second harvest, fruit number was determined, and fruit drop rate was calculated. Some of the significant quality losses including puffiness were reduced on trees treated with GA_3 twice. Fruit drop could also be prevented with GA_3 treatments. Fruit skin colour advanced rather slowly in GA_3 applied trees, however this effect became non-significant towards the end of the storage period. Ca applications alone did not exert major effects. On the other hand, all treatments with GA_3 had positive effects in terms of on-tree storage.

Bisen *et al.* (2014) examined the effect of calcium nitrate and gibberellic acid (GA_3) application on growth, fruit quality and post-harvest behaviour of guava fruit cv. Allahbad Safeda. Guava trees were sprayed with 0, 25, 50 and 100 ppm GA_3 and 0, 1.0, 1.5 and 2.0% of calcium nitrate. Fruit quality was evaluated at harvest in terms of size, firmness, specific gravity, number of seeds and total soluble solids (TSS), total sugars, reducing sugar, non reducing sugar, calcium content, ascorbic acid, acidity, physiological loss in weight and decay loss to determine the optimum application. Medium concentration of calcium nitrate and higher concentration of gibberellic acid alone with combination of $C_2 + G_3$ (calcium nitrate 1.5% + GA_3 100 ppm) were found superior over all treatments in terms of parameters observed.

Effect of potassium nitrate on post-harvest behaviour of guava fruits

Dutta (2004) examined the effects of the foliar application of K_2SO_4, KCl and KNO_3 at 1 or 2% on the yield and quality of guava (cv. L-49). Spraying of K significantly enhanced the yield and quality of guava. K_2SO_4 at 2% resulted in the greatest fruit weight (101.20 g), fruit length (5.25 cm), fruit diameter (5.92 cm), yield (6.20 kg per plant), total soluble solids (9.80^{o}Brix), total sugars (7.02%) and reducing sugar (3.98%) contents. Potassium reduced the ascorbic acid content but did not significantly affect the titratable acidity of fruits.

Prasad *et al.* (2015) evaluated the effect of foliar spray of micronutrients on Pear. Fifteen-year-old pear trees were treated with three concentrations (1.0, 1.5 and 2.0%) of calcium and potassium nutrients, *viz.,* calcium chloride, calcium nitrate, potassium sulphate and potassium nitrate; and water spray as a control at 30 day intervals starting from fruit set. The observations were recorded on the basis of biochemical characters, *viz.,* total soluble solids, acidity, ascorbic acid contents, total sugars, reducing sugar and non-reducing sugar. Fruits treated with potassium nitrate at 1.5% showed the highest total soluble solids (11.72ºBrix), total sugars (7.62%), reducing sugars (6.10%) and non-reducing sugars (1.51%). However, titratable acidity (0.46%), and ascorbic acid (6.42 mg/100 g) were found maximum with calcium chloride at 2.0% concentration. Therefore, on the basis of economics point of view reducing the excessive cost of applied inputs by use of micronutrients can be an alternative to get quality produce. So, these

treatments were recommended for adoptation of Patharnakh pear in *tarai* region.

Effect of calcium compound on post-harvest behaviour of guava fruits

Jayachandran *et al*. (2005) studied pre-harvest spray of calcium compounds. It was reduced the physiological loss in weight and titratable acidity, while they increased TSS, reducing sugars and pectin contents. However, higher concentration of calcium nitrate was more effective than other treatments. The fruit firmness increased as the concentration of calcium increased in the fruits. Calcium nitrate delayed softening and enhanced the shelf-life of fruits of guava.

Rajput *et al.* (2008) obtained the maximum shelf-life, TSS, ascorbic acid, pectin content and minimum titrable acidity of guava fruits with 2.0% Ca $(NO_3)_2$ pre-harvest spray and 2.0% $Ca(NO_3)_2$ post–harvest dip. Pre and post-harvest application of calcium compounds and bavistin significantly affected the shelf life of guava fruits and calcium nitrate was proved better than calcium chloride and cardendazim. There was gradual increase in TSS up to 6 days and decline thereafter, however higher ascorbic acid and pectin content were maintained up to 9 days of storage in all the treatments. Titrable acidity declined gradually with the increasing storage period.

Randhawa *et al.* (2009) examined pre-harvest treatments like $CaCl_2$ (0.5, 1.0, 2.0%), Ca $(NO_3)_2$ (0.5, 1.0, 2.0%), gibberellic acid (GA_3) (20, 40, 60 ppm) and cardendazim (0.1%) on the storage behaviour and quality of 'Umran' variety ber (*Zizyphus mauritiana* Lamk.) fruits during cold storage was studied. Ber plants of same age and size were sprayed with the test chemicals at colour break stage. Harvested fruits from treated plants were packed in corrugated fibre board boxes and cold stored (3-5 ^{o}C, 85- 90 % RH) and evaluated after 10, 20 and 30 days for physiological loss in weight, firmness, pectin methyl esterase (PME) activity and sensory rating. The physiological loss in weight increased and fruit firmness decreased during storage. The sensory rating increased up to 10 days in all the treatments, except control but subsequently it decreased during storage. The rate of increase in PME activity was faster up to 10 days in untreated fruits while treated fruits showed slower rise in PME activity up to 20 days and declined

afterwards. Fruits can be stored up to 20 days by pre-harvest spray of $CaCl_2$ (2%) and GA_3 (60 ppm) treatment, with minimum loss in quality.

Goutam *et al.* (2010) investigated the influenced of pre-harvest foliar application of calcium nitrate on quality attributes of winter guava cv. 'Sardar' during different interval of cold storage and post cold storage shelf-life under ambient conditions. Plants were sprayed with calcium nitrate solutions (0.5, 1.0 and 1.5%) at colour break stage of fruit. The fruits were harvested at optimum maturity. Bruise and disease free fruits were packed in corrugated fibre board boxes with newspaper lining and stored at 6–8°C and 90–95% RH. The fruits were evaluated after 10, 20, 30 and 40 days of storage and during shelf-life at 2 and 4 days interval. Physiological loss in weight and spoilage of fruits increased and firmness, ascorbic acid and acidity decreased continuously during storage. Fruits treated with 1% $Ca(NO_3)_2$ effectively reduced spoilage, maintained higher firmness, total soluble solid and ascorbic acid up to 2 days under ambient conditions after 30 days of cold storage and remained moderately acceptable up to the 40 days of storage.

Rajput (2010) studied that the calcium nitrate 2% had improved the fruit quality including the highest TSS, reducing sugar, total sugars, ascorbic acid and pectin content, while recording the lowest titratable acidity in guava fruits. Thus, the highest level of calcium nitrate improved the quality parameters of guava fruits under this study. Calcium nitrate 1% spray also improved the fruit quality traits in comparison to calcium chloride and control. The highest ascorbic acid and pectin content among all the treatments was recorded with 2% calcium nitrate, which signifies positive role of calcium nitrate in improving the fruit quality.

Abdrabboh (2012) examined the effect of pre-harvest treatments using calcium chloride (1.5%), calcium EDTA (1.5%), calcium nitrate (2%) and zinc sulphate (0.4%) on some fruit quality of 'Canino' apricot fruits under cold storage conditions. All treatments were done one month before maturity stage. The results showed that fruit weight loss (%), decay (%), total soluble solids (%), T.S.S./acid ratio and total sugars of fruits were increased with prolonging the period of cold storage, while fruit firmness and acidity were decreased by prolonging it. Calcium nitrate (2%) was the best treatment for

improving fruit quality under cold storage conditions comparing with other treatments.

Agrawal (2012) recorded that the pre-harvest spray of 2 per cent calcium nitrate solution and post harvest dip in 2 per cent calcium nitrate solution showed the highest shelf-life of guava fruits followed by pre-harvest spray of 2 per cent starch (potato) solution and post-harvest dip in 2 per cent calcium nitrate solution. The lowest values of shelf-life of guava fruit were recorded with pre-harvest spray of distilled water and post-harvest dip in any treatments.

Alila and Achumi (2012) analyzed the influence of pre-harvest sprays of calcium chloride (0.5 and 0.6%), calcium nitrate (1, 1.5 and 2%) and boric acid (0.2, 0.4 and 0.6%) and control (distilled water with few drops of Teepol). First applications of these chemicals were done when fruits were at bean-seed size and second application two weeks prior to harvest. Pre-harvest application of 4% boric acid resulted in higher TSS and lower acidity content in fruits during storage (5-7°C). Total sugars (15.92%) and reducing sugars (11.94%) were also enhanced with 4% boric acid pre-harvest application. The physical parameters of fruits (weight and diameter of fruit and pulp weight) were found to be positively influenced with the application of calcium nitrate at 1.5% as pre-harvest spray.

Bhat *et al.* (2012) treated the fruits of pear with calcium chloride and showed delayed colouration, improved, fruit firmness, organoleptic rating, TSS, sugars , both peel and flesh calcium content and reduced physiological loss in weight, spoilage and pulp acidity. After 15 days of storage period, fruit colour, physiological loss, spoilage, organoleptic rating increased and fruit firmness decreased. Comparatively, TSS, sugars, starch contents, calcium content (both peel and flesh) increased and the acid content decreased. Fruits harvested 110 and 115 DAFB and treated with calcium chloride at 0.5 and 0.75% retained better all the physicochemical characteristics along with enhanced storage-life and keeping quality.

Chahal and Bal (2012) judged the efficacy of different levels of calcium chloride ($CaCl_2$) and calcium nitrate {$Ca(NO_3)_2$} for retaining the fruit quality during delayed harvesting. There were six chemical treatments and the experiment was replicated three times. The fruits from the trees were

harvested at different stages of maturity (1st January, 15th January, 1st February and 15th February) and were subjected to physico-chemical evaluation. On the basis of two years observation, calcium chloride ($CaCl_2$) at 6 per cent and calcium nitrate {$Ca(NO_3)_2$} at 0.3 per cent proved their effectiveness in delaying the harvest maturity of the Kinnow mandarin fruits. However, the TSS, total sugars and reducing sugars level of these treated fruits was find to be lower in comparison to control. The acidity level was recorded to be higher than control.

Kumar *et al.* (2012) evaluated the effects of concentrations of competitive ethylene antagonist calcium salts on conservation of 'Sardar' guava fruits. Treatments consisted of 0.5 & 1% calcium nitrate, 1 & 2% calcium chloride and 0.5 & 1% calcium sulphate for 12 days followed by storage at room temperature. The application of 1% calcium chloride for 12 days was efficient in delaying loss of skin colour and in keeping fruit firm at room temperature storage. The calcium nitrate at 1% concentration was efficient in delaying skin colour loss only when fruits were stored at 25°C. The effect of calcium nitrate was quite significant on the reduction of acceptability in both the year. The product was efficient in delaying the ripening of fruits and the calcium chloride 1% showed the best effect.

Ali (2014) obtained results showed that, spraying with calcium nitrate at 0.6% with spring summer date gave the lowest values of titratable acidity and the highest values of total sugars. Moreover, spraying with calcium nitrate at 0.6% with autumn winter date gave the lowest values of weight loss, the highest values of fruit firmness of flesh, the lowest values of decay percentage, the highest values of total soluble solids and the lowest values of incidence of rot per cent in both seasons at shelf-life storage about 10 days. We can be recommended by spraying calcium nitrate at 0.6% 80-85 days after full bloom in both dates to get the best results of fruit quality.

Chauhan *et al.* (2014) examined the role of pre-harvest foliar application of Ca, Zn and B on respiration rate and biochemical changes during storage of mango fruit was investigated. Test chemicals (Ca, Zn and B) significantly reduced the respiration rate as compared to untreated ones. In untreated fruits climacteric peak appeared at about 6th days, while in treated fruit it occurred at about 9th days of storage. Treated fruits had delayed

ripening for about 3 days as compared to control. An increase in TSS and carotenoids was noted up to 9^{th} days of storage under all treatments, thereafter, value of TSS and carotenoids slightly decreased. The tannin, starch and pectin contents were decreased gradually as the storage advanced. However, the fruits received the treatments of Ca, Zn and B showed higher retention of tannins, starch and pectin in both fresh and stored fruits.

Goswami *et al.* (2014) studied pre-harvest application of calcium nitrate, boric acid and zinc sulphate on the physico-chemical quality and storage behavior of guava (*Psidium guajava* L.) fruits cultivar L-49, it was observed that the fruit length, diameter and volume were maximum under zinc sulphate 0.4 per cent. The maximum weight was observed under 0.4 per cent boric acid and it was at par with zinc sulphate 0.4 per cent. The zinc sulphate 0.4 per cent significantly improves the physicochemical quality, *viz*., total soluble solids, acidity, ascorbic acid, reducing, non-reducing and total sugar at harvest. The physiological loss in weight after harvest was minimum under zinc sulphate at 0.4 per cent closely followed by boric acid at 0.4 per cent. Minimum degree of spoilage was also observed with the application of 0.4% zinc sulphate followed by 0.4% boric acid.

Karemera and Habimana (2014) revealed that 1.5% $CaCl_2$ significantly increased the number of days taken for ripening of fruits, the shelf-life of fruits, physico-chemical parameters and organoleptic evaluation of mango cv. Alphonso fruits compared to control.

Parkhe *et al.* (2015) sprayed chemicals *viz.,* $CaCl_2$ (1%), $Ca(NO_3)_2$ (1%), $ZnCl_2$ (0.2%), Borax (1 %), $Ca(NO_3)_2$ (1 %) + $ZnCl_2$ (0.2%), $Ca(NO_3)_2$ (1%) + NAA 100 ppm) and water one month prior to harvesting. Application of these chemicals especially calcium salts was found to be effective in improving yield and quality of guava fruit.

Deepthi *et al*. (2016) studied effect of post-harvest treatments with calcium chloride (1 and 2%) and calcium nitrate (1 and 2%) on the storage behaviour of guava (cv. Lucknow-49) fruits harvested at mature green and colour turning stages during storage at low temperature. Fruits were packed in newspaper lined corrugated fibre board boxes, cold stored (10 ± 1^0C and 90 ± 5% RH) and evaluated after 5, 10, 15 and 20 days for various physico-

chemical attributes like PLW, firmness, TSS, acidity, ascorbic acid, pectin content and sensory rating. It was observed that PLW increased, while firmness, acidity and ascorbic acid decreased during storage irrespective of maturity stages and calcium treatments studied. However, TSS and sensory rating increased up to 10 days with all the treatments except control but subsequently decreased thereafter during storage. However, MG stage fruits exhibited longer shelf-life and better fruit quality with all the Calcium treatments compared to CT stage during storage. Similarly, calcium proved beneficial in delaying the ripening related changes in guava fruits, while application of $Ca(NO_3)_2$ (2%) recorded a potential shelf-life of 23.83 days under cold storage.

Gupta and Singh (2016) found that one per cent calcium chloride + 0.1% bavistin most effective pre-harvest treatment to enhance the post-harvest shelf-life of aonla (*Emblica officinalis* Gaertn.) fruits up to 20 days. This treatment had maximum effect on all the attributes of fruit quality like increased levels of TSS, total sugar and non-reducing sugar *vis a vis* low levels of acidity, ascorbic acid and reducing sugar. Minimum weight loss of 4.78 and 4.84% and decay loss 5.95 and 5.82% was also recorded with this treatment. Thus, this treatment doubled the shelf-life of aonla fruits during storage at room temperature.

Pisutpiboonwong and Khurnpoon (2017) sprayed mulberry fruit with 2% $CaCl_2$ resulted in significantly different in number of fruit and number of branch, non-significantly different in number of leaf, branch length and fruit size. Fruit sprayed with 2% $CaCl_2$ had lower in percentage of weight loss (0.28%) when compared to non-sprayed fruit (1.61%). Significantly differences between non-sprayed and sprayed with 2% $CaCl_2$ were found in fruit firmness and TSS/TA ratio, sprayed fruits had higher in fruit firmness and lower in TSS/TA ratio than non-sprayed fruits. L* and a* values decreased throughout the shelf-life, rapidly decreased in non-sprayed fruits. Development of anthocyanin content in fruit was reduced by $CaCl_2$, 2 time lower content than non-sprayed at the accumulation peak (days 12 in storage). Thus, $CaCl_2$ could enhanced number of fruits and delayed the ripening of mulberry fruits during storage.

Patel *et al.* (2017) sprayed chemicals like $CaCl_2$ @ 0.5, 1 and 1.5%; Ca $(NO_3)_2$ @ 0.5, 1 and 1.5%; $CaSO_4$ @ 0.5, 1 and 1.5% along with control (water) sprayed on 20 years old tree of sapota cv. Kalipatti three weeks before harvest and fruits were stored at ambient condition. The spraying of $CaCl_2$ @ 1% found effective for increasing total soluble solids, total sugars, reducing sugar, non-reducing sugar, ascorbic acid with minimum acidity and moisture content of sapota fruits. While, pre-harvest spraying of $CaCl_2$ @ 1.5% improved calcium content of sapota fruits.

Panwar *et al.* (2017) evaluated the effect of different chemicals on fruit quality and shelf life of litchi fruits. Four chemicals were applied *viz*., calcium nitrate, calcium chloride, boric acid, salicylic acid and humic acid on litchi plants. Physiological loss in weight of fruits (9.36%) was minimum with Salicylic acid (50 µ mol l-1). Higher total soluble solids (20.89°Brix) were recorded with Calcium nitrate (0.5%). Minimum treatable acidity (0.29%) was recorded in Calcium nitrate (0.5%) and humic acid (0.4%). TSS: acid ratio (71.56) was maximum with humic acid (0.4%). Browning index (4.97) was minimum with calcium chloride (0.5%). Spoilage percentage (20.32%) was minimum with calcium chloride (0.5%).

Sharma and Pritima (2018) enhanced peach fruit quality and reducing fruit deterioration during shelf life studies of five subtropical peach cultivars. At harvest fruit quality parameters *viz.*, TSS, acidity, firmness etc. were influenced greatly by the treatments. Other physical properties of the fruit such as fruit weight, size and yield were not influenced much. Physiological weight loss during storage and the deterioration of other fruit characteristics were considerably lowered by calcium treatments. Foliar application of calcium nitrate (1%) was found to be superior over calcium chloride (2%) for improving fruit quality and shelf-life.

Effect of calcium and potassium on post-harvest behaviour of guava fruits

Kumar *et al.* (2015) comprised foliar sprays of boron, zinc, calcium and potassium at two stages, *viz*., at fruit set or two weeks after fruit set on guava plant. The foliar fertilization showed an increasing trend towards plant height (12.17% with 0.03% Zn two weeks after fruit set), fruit weight (150 g with 0.03% B two weeks after fruit set), volume (147.67 with 0.03% B two weeks

after fruit set) and yield (52.50 kg/tree with 0.01% Zn two weeks after fruit set). Similarly, pulp: seed ratio (94.88 with 0.5% K two weeks after fruit set), TSS (11.50^{0}Brix with 0.5% K on fruit set) and total sugars (7.36% with 0.5% K two weeks after fruit set) also increased by foliar fertilization while it showed a trend towards decreasing per cent fruit drop (5.90% with 0.03% Zn two weeks after fruit set) and acidity content (0.26% with 0.5% K two weeks after fruit set). The seed hardness (11.48 kg with 0.01% B on fruit set) showed non uniform pattern. The stage of growth also affected the growth, yield and quality of guava fruits. Results indicated that foliar fertilization when done two weeks after fruit set influenced plant growth and fruit quality.

Mishra *et al*. *(*2017) studied the effect of pre-harvest nutrients of calcium chloride, potassium sulphate and zinc sulphate on the physicochemical quality and storage behavior of rainy season guava (*Psidium guajava* L.) fruits cultivar L-49. It was observed that the fruit length and width were maximum under potassium sulphate 1 per cent. The maximum weight was observed under potassium sulphate 1 per cent calcium chloride 0.2 per cent and it was at par with potassium sulphate 0.2 per cent. The potassium sulphate 1 per cent significantly improves the physicochemical quality, *viz*., total soluble solids, acidity, ascorbic acid, reducing, non-reducing and total sugar at harvest. The physiological loss in weight after harvest was minimum under calcium chloride 1 per cent closely followed by calcium chloride 1.5 per cent. Maximum fruit firmness was also observed with the application of potassium sulphate 0.6 per cent and minimum found in calcium chloride 1 per cent.

Effect of gibberellic acid, calcium and potassium on post-harvest behaviour of guava fruits

Jakhar and Pathak (2014) enhanced the fruit quality of Amrapali mango with pre-harvest foliar spray of $CaCl_2$@ 2% and K_2SO_4@ 1% and fruit bagging. Trees of Amrapali mango were sprayed three times at 30, 20 and 10 days before harvesting. Fruit bagging with brown paper bag was employed at 20 days before harvesting of fruits. The results indicated that the spray of 2% $CaCl_2$ and 1% K_2SO_4 combined with bagging was found superior to increase the quality of fruits in respect of fruit weight, TSS, ascorbic acid, sugars, β-carotene content and TSS: acid ratio and decrease the total acidity with

minimum black spotted fruits per cent and highest organoleptic quality among all treatments in both the seasons.

Lal *et al.* (2015) noted that the foliar application of gibberellic acid 100 ppm, NAA 20 ppm significantly reduced fruit drop (16.80 and 14.28%) and calcium nitrate at 2.0 per cent (23.28%) was recorded. Higher level of gibberellic acid 100 ppm and calcium nitrate at 2.0 per cent delayed maturity by (296.95 and 293.58 days). Harvested fruits were stored up to different days at ambient temperature in 100 gauge polythene bags. It was recorded that the calcium nitrate at 2.0 and 1.5 per cent and NAA 20 ppm prove more effective in minimizing the loss of fruit spoilage, fruit weight, fruit juice, ascorbic acid, TSS and total sugars.

Jakhar and Pathak (2016) studied the effect of pre-harvest bagging and spray of $CaCl_2$ and K_2SO_4 on quality and shelf-life of mango fruits cv. Amrapali during two succeeding years. Trees of Amrapali mango were sprayed three times at 30, 20, and10 days before harvesting and bagging with brown paper bag 20 days before harvesting of fruits. Harvested fruits were stored under the ambient temperature (storage at room temperature) and observations were taken at three days intervals up to 18 days. The results indicated that the pre-harvest treatment of 2% $CaCl_2$ + 1% K_2SO_4 + bagging was found superior to improve the quality of fruits in respect of highest fruits weight, firmness, TSS, ascorbic acid, total sugars, and β-carotene content with minimum black spotted fruits per cent and maintained it throughout the storage period up to 18 days. Fruits treated with 2% $CaCl_2$+1% K_2SO_4+bagging showed shelf-life up to 12 days with lowest weight loss and highest organoleptic quality as against 6 days of untreated fruits (control).

Vishwakarma *et al.* (2017) studied the effect of pre-harvest application of different chemicals and plant growth regulators on physical parameters and shelf-life of mango (*Mangifera indica* L.) cv. Amrapali. The plants of mango were pre-harvest sprayed with $CaCl_2$ 1%, $CaCl_2$ 2%, $Ca(NO_3)_2$ 1%, $Ca(NO_3)_2$ 2%, KNO_3 1%, KNO_3 2%, GA_3 25 mg/l, GA_3 50 mg/l, ethrel 0.1 ml/l and ethrel 0.2 ml/l. Fresh and mature fruits were harvested from trees which was pre-harvest sprayed with different chemicals and plant growth regulators and stored under ambient storage condition. Among all the treatment, GA_3 25 mg/l treatment recorded significantly highest fruit length, fruit diameter and fruit

volume at harvest and at fully ripening stage whereas, same treatment also obtained the significantly maximum fruit weight consistently at harvest and every day up to 16th day under ambient storage condition. The pre-harvest application of $CaCl_2$ 2% recorded significantly minimum physiological loss in weight consistently during 2nd day and every day up to 16th day whereas, same treatment recorded significantly highest shelf life of fruit. However, pre-harvest treated fruits with $CaCl_2$ 2% also recorded significantly maximum marketable fruits (%) and minimum spoilage (%) at 13th day, 14th day, 15th day and 16th day under ambient storage condition.

Effect of other chemicals on post-harvest behaviour of guava fruits

Omayma *et al.* (2010) explored the use of some post-harvest treatments to extend the marketable shelf-life of guava and to alleviate some pathogenic disorders. Mature yellowish-green guava fruits cv. Maamoura were treated with hot water, hydrogen peroxide (H_2O_2), calcium chloride grass oil fumigation and various combinations between them and then stored at 8±1°C with 90% relative humidity (RH) for 15 days. Fruits were transferred to room conditions at (22 ±2°C and 55-60 %RH) till the end of the fruit marketable period. Fruits of all treatments showed lower fruit weight loss, decayed fruits and long marketable-life period in comparison to untreated (water only). Calcium chloride + lemon grass fumigation treatment gave fruits with high quality than other treated fruits. Ascorbic acid and total pectin values were the highest with calcium chloride + lemon grass fumigation treatment than in the control and other treated fruits, whereas acid % and SSC values were the lowest. All tested treatments greatly reduced rhizopus rot infection value after 10 days at 8±1°C, rot infection percent was 100% in control fruit, whereas very little infection value was observed in treated fruit. Fruits treated with Calcium chloride + lemon grass fumigation were completely rhizopus rot free through 15 days storage at 8±1°C. The sensory evaluation showed that this treatment could maintain appearance considered the most benefit fruit appearance, physical, chemical fruit properties and free from rots at 8±1°C for two weeks. This treatment considered the most benefit tested one.

Goswami *et al.* (2012) found that zinc sulphate 0.4 per cent most effective for improving the physicochemical parameters at harvest and prolonged the shelf-life of fruits exhibiting lower degree of post harvest losses.

Nishad *et al.* (2012) studied to improve the shelf-life of guava cv. Apple Colour fruit by the use of different chemicals composition, waxol per cent ages and pack aging materials. Treated fruits of guava cv. Apple Colour were stored at room temperature. There was decrease in vitamin-C (mg/100 g) and acidity during storage period of guava fruit under room temperature. The increase in TSS and juice pH and physiological loss in weight of fruit was noticed in storage period irrespective of post harvest treatment and room temperature. All the treatments were found better in respect of TSS & ascorbic acid con tent over control. On the basis of results obtained the treatment combination waxol 6% + carbendazim 0.2%) proved to be the best in terms of fruit quality and better shelf-life at room temperature.

Jakhar and Pathak (2015) treated Amrapali mango fruits with the combination of HWT+ wax coating showed the slower rate of chemical changes and retain the highest TSS (20.18 and 20.48%), acidity (0.15 and 0.14%) and ascorbic acid (47.37 and 47.05 mg/100g) up to 18 days of storage during both years, respectively. Similarly, the separate treatment of wax coating was also found superior to retain the highest sugars (15.95 and 16.30%), β-carotene (5056 and 5080 µg/100g) and TSS acid ratio (144.14 and 156.46). The shelf life of fruits was effectively extended by both the treatments up to 15^{th} day of storage, although fruits treated with the combination treatment of HWT+ wax coating showed the minimum PLW (12.96 and 12.28%). Fruits treated with wax coating and combination of HWT+ wax coating were also found organoleptically acceptable up to 15 days of storage. In conclusion, the post harvest treatment with wax coating and combination of HWT+ wax coating was found to be effective for maintaining the quality of fruits with the extended storage life and acceptability up to 15 days under ambient conditions.

Marzouk and Kassem (2011) sprayed ten-year-old Thompson seedless grape vines during 2009 and 2010 growing seasons with putrescine (Put), gibberellic acid (GA_3), ascorbic acid (AA), ethephon (Eth), salicylic acid (SA), cytofex (CPPU) and calcium chloride ($CaCl_2$) at two stages of berry

development; pea stage (4–5mm fruitlet diameter, ~30–35 days after fruit set) and veraison stage (when approximately 20% of the berries on 50% of the clusters had softened) in order to investigate their influence on yield and postharvest fruit quality characters at commercial harvest day as well as the berry keeping quality. Cluster and berry quality characters as well as vine yield were improved by all sprayed chemicals, especially Put, GA_3, SA, CPPU and $CaCl_2$. GA_3 increased cluster and berry width, and resulted in better clusters shape. A positive increase in berry firmness was obtained by Put, GA_3, CPPU, SA and $CaCl_2$ sprays. Berry adherence strength increased and the percentage of unmarketable berries decreased by all sprayed compounds except Eth. Shelf-life (keeping quality) was increased by spraying Put, GA_3, SA, CPPU and $CaCl_2$, as they increased berries firmness and decreased the percentage of unmarketable berries after keeping at ambient temperature for seven days after harvest.

Chapter- III
MATERIAL AND METHODS

An investigation entitled **"Effect of Pre-harvest Spray of GA_3, Calcium Nitrate and Potassium Sulphate on Post-harvest Behaviour of Guava (*Psidium guajava* L.) Fruits of Cultivars Dharidar and Chittidar"** was carried out in the Department of Fruit Science, KNK College of Horticulture Mandsaur (M.P.) during the two successive seasons 2015-2016 and 2016-2017. The details of techniques followed and materials used during the course of experimentation are mentioned as below.

3.1 Location

The experiment was conducted at the *Instructional cum Research Fruit Orchard* and Laboratory of Department of Fruit Science, K.N.K. College of Horticulture, Mandsaur Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (M.P.), during the two successive seasons of 2015-2016 and 2016-2017.

3.2 Climatic conditions

Mandsaur is situated at 23.45^0 to 24.13^0 N latitude and 74.44^0 to 75.18^0 E longitudes at an altitude of 435 m MSL. It has sub-tropical climate with hot summer and cool winter. The temperature rises up to 46^0C during summer and falls to 5^0C during winter with an occasional occurrence of frost. The average rainfall is 579.2 mm, most of which occur during July to September, winter and summer rain are uncommon.

The meteorological data such as maximum (23.70^0C) & (28.10^0C) and minimum (8.2^oC) & (10^oC) temperature and Relative humidity (%) were recorded during the experimental period and are presented in Table 3.1 & 3.2 and graphically represented in Fig. 3.1 & 3.2.

Table: 3.1 Daily meteorological observations during the storage period (December 2015)

S. No.	Date	Temperature (2015)	Relative Humidity **(%)**

		Minimum temperature (^{0}C)	Maximum temperature (^{0}C)	
1.	21 December	8.4	22.9	71
2.	22 December	8.5	22.9	70
3.	23 December	8.3	22.6	73
4.	24 December	8.4	22.5	70
5.	25 December	8.3	22.6	73
6.	26 December	8.2	22.1	72
7.	27 December	8.3	22.4	70
8.	28 December	8.8	22.9	71
9.	29 December	10.1	23.7	67

Source: Meteorological data recorded in meteorological laboratory of College of Horticulture Mandsaur (M.P.)

Table: 3.2 Daily meteorological observations during the storage period (December 2016)

S. No.	Date	Temperature (2016)		Relative Humidity **(%)**
		Minimum temperature (^{0}C)	Maximum temperature (^{0}C)	
1.	21 December	11.7	28.0	49
2.	22 December	11.4	28.1	52
3.	23 December	11.5	27.9	54
4.	24 December	11.4	27.8	55
5.	25 December	10.9	27.7	52
6.	26 December	10.8	27.0	57
7.	27 December	10.5	27.0	50
8.	28 December	10.0	27.0	60
9.	29 December	10.2	27.5	56

Source: Meteorological data recorded in meteorological laboratory of College of Horticulture Mandsaur (M.P.)

3.3 Experimental materials

3.3.1 Preparation of chemical solutions

For preparation of 1 and 2% calcium nitrate solution, 10 and 20 g Ca $(NO_3)_2$ were dissolved in 1 litre of water, respectively. Similarly, for preparation of 1 and 2% K_2SO_4 solution, 10 and 20 g potassium sulphate were dissolved in 1 litre water. The stock solution of GA_3 was prepared by dissolving 1 gram of GA_3 in 10 ml absolute alcohol and added double distilled water to make the volume of 1 litre.

3.3.2 Selection of fruits

Fruits from experimental trees were harvested during the third week of December at the optimum horticultural maturity. The bruised and diseased fruits were sorted out and only healthy and blemish-free fruits of 2 kg were selected for this present study.

3.3.3 Storage

After picking the fruits were kept in plastic trays and stored at room temperature and relative humidity. The details of room temperature and relative humidity fluctuations during the course of investigation are given in Table 3.1. The pre-harvest sprayed fruits were subjected to various physico-chemical observations as per details given below at 0, 3rd, 6th and 9th days at storage, respectively.

3.4 Experimental details

Seventy eight trees of guava cvs. Dharidar and Chittidar were selected and tagged for experiment work at the time of colour break stage (20 days before harvesting). The experiment comprised of twenty six treatment combinations consisting of GA_3, calcium nitrate and potassium sulphate. Single foliar spray of GA_3, calcium nitrate and potassium sulphate and their combinations were done in the month of December 2015 and 2016 and the fruits harvested after 20 days and stored up to 9 days at 3 day intervals.

3.4.1 Experimental design and layout

Name of crop	:	Guava (*Psidium guajava* L.)

A. Cultivars

1. Dharidar (V_1)
2. Chittidar (V_2)

B. Plant growth regulator and nutrients

T_0	Control (Water spray)
T_1	GA_3 50 ppm
T_2	GA_3 100 ppm
T_3	Calcium nitrate 1%
T_4	Calcium nitrate 2%
T_5	Potassium sulphate 1%
T_6	Potassium sulphate 2%
T_7	GA_3 100 ppm+ Calcium nitrate 2%
T_8	GA_3 100 ppm+ Potassium sulphate 2%
T_9	GA_3 50 ppm+ Calcium nitrate 1%+ Potassium sulphate 1%
T_{10}	GA_3 50 ppm+ Calcium nitrate 2%+ Potassium sulphate 2%
T_{11}	GA_3 100 ppm+ Calcium nitrate 1%+ Potassium sulphate 1%
T_{12}	GA_3 100 ppm+ Calcium nitrate 2%+ Potassium sulphate 2%

Number of plant(s) per treatment	:	01
Number of replications	:	03
Number of treatments	:	26
Total number of plants	:	78
Experimental design	:	Factorial RBD
Age of plants		9 years
Plant spacing		6 m x 6 m

Table 3.3 Treatment combinations

Detail of treatments	Symbol
Control (Water spray)	V_1T_0

GA_3 50 ppm	$\mathbf{V_1T_1}$
GA_3 100 ppm	$\mathbf{V_1T_2}$
Calcium nitrate 1%	$\mathbf{V_1T_3}$
Calcium nitrate 2%	$\mathbf{V_1T_4}$
Potassium sulphate 1%	$\mathbf{V_1T_5}$
Potassium sulphate 2%	$\mathbf{V_1T_6}$
GA_3 100 ppm+ Calcium nitrate 2%	$\mathbf{V_1T_7}$
GA_3 100 ppm+ Potassium sulphate 2%	$\mathbf{V_1T_8}$
GA_3 50 ppm+ Calcium nitrate 1%+ Potassium sulphate 1%	$\mathbf{V_1T_9}$
GA_3 50 ppm+ Calcium nitrate 2%+ Potassium sulphate 2%	$\mathbf{V_1T_{10}}$
GA_3 100 ppm+ Calcium nitrate 1%+ Potassium sulphate 1%	$\mathbf{V_1T_{11}}$
GA_3 100 ppm+ Calcium nitrate 2%+ Potassium sulphate 2%	$\mathbf{V_1T_{12}}$
Control (Water spray)	$\mathbf{V_2T_0}$
GA_3 50 ppm	$\mathbf{V_2T_1}$
GA_3 100 ppm	$\mathbf{V_2T_2}$
Calcium nitrate 1%	$\mathbf{V_2T_3}$
Calcium nitrate 2%	$\mathbf{V_2T_4}$
Potassium sulphate 1%	$\mathbf{V_2T_5}$
Potassium sulphate 2%	$\mathbf{V_2T_6}$
GA_3 100 ppm+ Calcium nitrate 2%	$\mathbf{V_2T_7}$
GA_3 100 ppm+ Potassium sulphate 2%	$\mathbf{V_2T_8}$
GA_3 50 ppm+ Calcium nitrate 1%+ Potassium sulphate 1%	$\mathbf{V_2T_9}$
GA_3 50 ppm+ Calcium nitrate 2%+ Potassium sulphate 2%	$\mathbf{V_2T_{10}}$
GA_3 100 ppm+ Calcium nitrate 1%+ Potassium sulphate 1%	$\mathbf{V_2T_{11}}$
GA_3 100 ppm+ Calcium nitrate 2%+ Potassium sulphate 2%	$\mathbf{V_2T_{12}}$

3.4 Observations recorded at 3 day interval up to 9 days

1. Physiological loss in weight (PLW %)
2. Decay loss (%)
3. Fruit length (cm)
4. Fruit diameter (cm)
5. Specific gravity
6. Marketable fruits (%)
7. Marketable fruits retained over control (%)
8. TSS (%)
9. Acidity (%)
10. Sugars (%)
    a) Reducing sugar b) Non-reducing sugar c) Total sugars
11. Pectin content (%)

    Note: Observations from S.No. 1 to 11 was recorded on 0, 3, 6 & 9 day at storage conditions

12. Sensory score
    a) Appearance b) Taste c) Flavour d) Texture
13. Colour
    a) External b) Internal
14. Microbial population/ development of pathogens

3.5 Methodologies used for observations

3.5.1. Physiological loss in weight (%)

For determination of physiological loss in weight (PLW), 2 kg fruits from each treatment were marked and labeled. The marked and labeled fruits in each treatment were weighed prior to storage. Their weight was determined on 0, 3rd, 6th and 9th day of storage. Physiological loss in weight was expressed on per cent basis on the basis of original weight of fruit.

Physiological loss in weight (PLW) of the fruit was determined with formula given by Srivastava and Tandon (1968).

$$\text{Per cent loss in weight} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

3.5.2 Decay loss (%)

Rotten fruits were visually counted out from total number of fruits in each treatment at an interval of 0, 3rd, 6th and 9th day of storage. Rotting was expressed on percentage basis.

$$\text{Per cent rotting} = \frac{\text{Rotten fruits}}{\text{Total fruits}} \times 100$$

3.5.3 Fruit length (cm)

The length of fruits was measured from stem end to calyx end in centimetres at 0, 3rd, 6th and 9th day during storage with the help of Vernier calipers.

3.5.4 Fruit diameter (cm)

The width of the fruits was measured from the centre of the fruits in centimetres at 0, 3rd, 6th and 9th day during storage with the help of Vernier Callipers.

3.5.5 Fruit Volume (c.c.)

The volume of fruit was recorded by water displacement method with the help of measuring cylinder and was expressed in cubic centimeters.

3.5.6 Specific gravity (g cc-1)

The specific gravity was obtained by dividing the weight of the fruit by the volume of the fruit water displaced.

3.5.7 Marketable fruits (%)

Marketable fruits are the number of fruits retained after decay loss on per cent basis.

Marketable fruits = 100 – Decay loss (%)

3.5.8 Marketable fruits retained over control (%)

Marketable fruits retained over control are obtained from the following formula. It is expressed in the per cent.

Marketable fruits retained over control (%) = marketable fruits (%) – marketable fruits in control (%)

3.5.9 Total soluble solids (^{0}Brix)

All the fruits of each plant were crushed to form a homogenized sample and then the juice was extracted through muslin cloth. The extract was used for determination of T.S.S. in (^{0}Brix) by hand refractometer. A few drops of juice were placed on the surface of prism. The hinged part was placed back. The refractometer was then placed against the sun and the reading was noted by revolving the eyepiece at room temperature (A.O.A.C., 2000).

3.5.10 Acidity (%)

Acidity was estimated by simple acid–alkali titration method as described in A.O.A.C. (2000). About 20 ml fruit juice solution was taken by pipette and transferred into a 100 ml flask and then distilled water was added to make up the volume up to 100 ml. It was shaken well to dissolve thereafter 0.25 ml of diluted fruit juice was taken by pipette and transferred into a 250 ml beaker, then 3 drops of phenolphthalene indicator was added in this solution. The burette was filled with N/10 NaOH solution and juice was titrated with alkali solution, drop by drop with constant stirring till the pink end point was reached. End point readings were recorded and the percentage acidity was calculated by the formula and expressed in terms of citric acid.

$$\text{Total acidity per cent} = 0.128 \times \text{titre value}$$

3.5.11 Sugars (%)

Sugars in fruit juice were estimated by the method as suggested by Nelson and Somogyi (1944).

(a) Preparation of fruit juice solution: A homogenous sample of pulp juice was prepared after crushing two gram of fruit in 20 ml of ethanol

and filtering by muslin cloth. About 20 ml of juice sample was diluted to 100 ml by distilled water and this solution was used for estimation of sugars.

(b) Preparation of Fehling's solution

(i) Fehling's solution "A": Weighed 34.63 g of copper sulphate (A.R.) crystals on an analytical balance was transferred to a clean and dry 500 ml volumetric flask. About 0.5 ml of concentrated sulphuric acid was added with some distilled water. Shaken well to dissolve and some distilled water was added to make the volume up to the mark (500 ml).

(ii) Fehling's solution "B": Dissolved 173.0 g of pure sodium potassium tartarate (Rochelle salt) and 50 g of sodium hydroxide in distilled water and made the volume (500 ml) in volumetric flask by adding distilled water.

(C) Glucose solution (0.5%): Dissolved 2.5 g of glucose (A.R. anhydrous) in distilled water and made the volume to 500 ml by adding distilled water.

(i) Reducing sugars

Reducing sugars in fruit juice was estimated by the method as suggested by Nelson (1944). About 5 ml each of Fehling's "A" and "B" solution were taken in a 300 ml conical flask and diluted with 40 ml of distilled water. The juice solution taken in a burette was added slowly in hot (boiling) Fehling's solution till the appearance of slight red colour. Now three drops of methylene blue indicator was added and titration was continued till a brick red precipitate appeared by destroying the blue colouration. The reducing sugar in percentage was calculated with the help of following formula:

$$\text{Reducing sugar (\%)} = (0.25/\text{Burette reading}) \times 100$$

(ii) Non-reducing sugars:

The difference in percentage between total sugars and reducing sugar was taken as the estimate of non-reducing sugars.

Non-reducing sugar (%) = Total sugars % - Reducing sugars (%)

(iii) Total sugars

For the estimation of total sugars, 20 ml of guava juice solution was taken in a beaker and 5 ml of concentrated HCl was added and then the solution was boiled on water bath for five minute for the hydrolysis to convert the non-reducing sugar in to reducing sugars. After cooling, the excess of acid was neutralized by sodium carbonate solution. The solution was transferred in a 100 ml volumetric flask and volume was made up to mark by adding distilled water. This solution was taken in a burette and titrated with the Fehling's A and B solution similar as was done in reducing sugars. The total sugar in percentage was calculated with the help of following formula.

Total sugars (%) = (0.25 / Burette reading) x100

3.5.12 Pectin content (%)

The fruits were crushed by means of pestle and mortar. About 100 g of crushed sample was taken and 200 ml of water added to it and boiled for half an hour. The process was repeated twice and the extract was made up to 250 ml. The sample was then tested for starch content with 0.1 percent iodine solution, which was negligible. Again 100 ml of the extract was centrifuged to get clear solution and 50 ml of this solution was taken out for the estimation of pectin according to the methods of Kertesz (1951).

3.5.13 Sensory score

The sensory rating of guava fruits was done by a panel of five semi trained judges on the basis of nine points Hedonic scale (1-9 points) intervals of 0, 3rd, 6th and 9th day were subjected to organoleptic evaluation by a panel of five judges following hedonic rating as described by Amerine *et al.* (1965). The guava fruits were evaluated for appearance, taste, flavor and texture.

(a) Appearance

The taste of fruits was judged by panel of five judges, on the basis of sweetness, blend, aroma etc. by organoleptic method. For this purpose a panel of five judges was chosen. The fruits were evaluated on the basis of the

above characteristics. The marks allotted to fruits of different treatment were classified into the following categories/ranks. The scoring was done by following pattern Table

Table 3.4 Sensory score for appearance

Scale	Category
9.0	Like Extremely
8.0	Like Very Much
7.0	Like Moderately
6.0	Like Slightly
5.0	Neither Like Nor Dislike
4.0	Dislike Slightly
3.0	Dislike Moderately
2.0	Dislike Very Much
1.0	Dislike Extremely

(b) Taste

The taste of fruits was five judged by panel of judges, on the basis of sweetness, blend, aroma etc. by organoleptic method. For this purpose a panel of five judges was chosen. The fruits were evaluated on the basis of the above characteristics. The marks allotted to fruits of different treatment were classified into the following categories/ranks. The scoring was done by following pattern Table 3.5.

Table 3.5: Sensory score for taste

Scale	Category
9.0	Like Extremely
8.0	Like Very Much
7.0	Like Moderately
6.0	Like Slightly
5.0	Neither Like Nor Dislike
4.0	Dislike Slightly

3.0	Dislike Moderately
2.0	Dislike Very Much
1.0	Dislike Extremely

(c) Flavour

The flavour of fruits was judged by panel of five judges, on the basis of smell and blend of the fruit pulp. The scoring was done by following pattern Table 3.6.

Table 3.6: Sensory score for flavour

Scale	Category
9.0	Like Extremely
8.0	Like Very Much
7.0	Like Moderately
6.0	Like Slightly
5.0	Neither Like Nor Dislike
4.0	Dislike Slightly
3.0	Dislike Moderately
2.0	Dislike Very Much
1.0	Dislike Extremely

(d) Texture

The texture of fruits was judged by panel of five judges, by the thumb and nail (thumb and finger) method. All four fruits in a given replication were judged.

The marks allotted to fruits of different treatment were classified into the following categories/ranks. The scoring was done by following pattern Table 3.7.

Table 3.7: Sensory score for texture

Scale	Category
9.0	Like Extremely
8.0	Like Very Much

7.0	Like Moderately
6.0	Like Slightly
5.0	Neither Like Nor Dislike
4.0	Dislike Slightly
3.0	Dislike Moderately
2.0	Dislike Very Much
1.0	Dislike Extremely

3.5.14 Colour

The colour of the guava fruits was judged by visual method. For this a panel of six judges was chosen who examined the fruit and score given by them was averaged. All the fruits in a given replication were judged. The fruits were placed in eight categories/ranks for external and four categories for internal colour.

Table.3.8: Colour

Category		
External		**Internal**
Greenish (G)	Dark yellow (DY)	Creamy white (CW)
Yellowish green (GY)	Brownish spot (BS)	Dull white (DW)
Light yellowish (LY)	Straw yellow (SY)	Straw white (SW)
Medium yellow (MY)	Dark brown (DB)	Brownish white (BW)

3.5.15 Microbial population/development of pathogens:

Development of pathogens on the fruit surface during the storage period at ambient room environment was evaluated in the pathology laboratory.

3.6 Economics of treatments

The economics of different treatments were calculated on the basis of various inputs used for particular treatment. The unit cost for each of the treatments was calculated separately and the cost so evolved was recorded. The net profit for the same in each treatment was calculated on the

particular day. Economics was calculated on the basis of market rate prevailed at that period.

3.7 Statistical analysis

The experiment was laid out in Randomized Block Design (RBD) with factorial concept and the data was subjected to analysis as per the procedure outlined by Panse and Sukhatme (1985).

To test the significance of variation in the data obtained the analysis of variance technique was adopted as suggested by 'Yates' for Factorial Randomized Block Design. The analysis of variance for different characteristics is presented in appendix. The Skeleton of ANOVA as per design is as given in Table below:

S.V.	DF	SS	MSS	F cal	F tab
REP	2	SS (R)	SS (R)/DF	MSS (R)/MSS (E)	3.102552
V	1	SS (V)	SS (V)/DF	MSS (V)/MSS (E)	2.710647
T	12	SS (T)	SS (T)/DF	MSS (T)/MSS (E)	1.942639
V X T	12	SS (V×T)	SS (V×T)/DF	MSS (V×T)/MSS (E)	1.591814
Error	50	SS (E)	SS (E)/DF		
Total	77				

The critical difference (C.D.) was calculated to assess the significance of difference between treatments, whenever the results were found significant through 'F' test, CD at 5 % level of significance was determined. S.Em. and CD are calculated using the following formula.

$$\text{S.Em.} \pm \text{ for Variety} = \sqrt{\frac{EMS}{R \times T}}$$

$$\text{S.Em.} \pm \text{ for Treatments} = \sqrt{\frac{EMS}{R \times V}}$$

$$\text{S.Em.} \pm \text{ for Interaction (V×T)} = \sqrt{\frac{EMS}{R}}$$

$$CD = S.Em. \pm \times \sqrt{2 \times t_{5\%\ (edf)}}$$

Where,

EMS	:	Error mean sum of squares
R	:	Replications
$t_{5\%}$	:	Table value at error degree of freedom
S.Em. $\pm$	:	Standard error of mean
CD	:	Critical difference

Chapter- IV

RESULTS

An investigation entitled **"Effect of Pre-harvest Spray of GA_3, Calcium Nitrate and Potassium Sulphate on Post-harvest Behaviour of Guava (*Psidium guajava* L.) Fruits of Cultivars Dharidar and Chittidar** was carried out in the Department of Fruit Science, K.N.K. College of Horticulture Mandsaur (M.P.) during the two successive years 2015-2016 and 2016-2017.

The results obtained during the course of investigation have been described in this study under appropriate headings. The analysis of variance for the characters has been appendices for reference in appendices. The observations are summarized in the form of tables & illustrated through figures wherever found necessary.

4.1 Physiological loss in weight (%) on 3rd, 6th and 9th day storage condition

Data presented in Table 4.1 and Fig. 4.1 to 4.9 showed that the minimum physiological weight loss (4.71, 7.51 and 12.11%) was recorded on 3rd, 6th and 9th days respectively in variety Chittidar fruits stored at ambient conditions during 2015-2016. In year of 2016-17 the minimum physiological weight loss (4.66, 7.37 and 12.20%) was recorded on 3rd, 6th and 9th days, respectively in variety Chittidar fruits stored at ambient conditions. Least value of physiological loss in weight was recorded in guava variety of Dharidar in both successive years.

Pooled analysis of the data 2015-16 and 2016-17 revealed that the increasing trends was noticed in both variety of guava fruits up to 9 days storage period, however the minimum loss in physiological weight (4.68, 7.44 & 12.16%) was recorded on 3rd, 6th and 9th days, respectively in guava variety Chittidar fruits stored at ambient conditions. Plant growth regulator and nutrients (GA_3, calcium nitrate and potassium sulphate) had significantly increased the loss in physiological weight as the storage period advanced irrespective of any treatments. The minimum physiological weight loss (3.01, 5.25 & 10.08%) were recorded on 3rd, 6th and 9th days, respectively with GA_3 @100ppm + calcium nitrate @ 2% + potassium sulphate @ 2% (T_{12}), followed

by T_7 (3.76, 5.50 & 10.70%) and T_{10} (3.92, 5.80 & 11.04%) at 3rd,6th & 9th days of storage during 2015-2016. In 2016-2017, T_{12} (GA_3 @100 ppm + calcium nitrate @ 2% + potassium sulphate) treatment exhibited the lowest physiological loss in weight (2.93, 5.16 & 10.01%) on 3rd, 6th and 9th days, respectively at ambient storage conditions which is statistically significantly best over all the other treatments which was followed by T_7 treatment (3.64, 5.42 & 10.63%) and T_{10} (3.85, 5.67 & 10.98%) on 3rd, 6th and 9th days, respectively, however maximum loss in physiological weight showed by control treatments.

Pooled analysis of the data 2015-16 and 2016-17 revealed that T_{12} (GA_3 @100ppm + calcium nitrate @ 2% + potassium sulphate @ 2%) recorded the minimum loss in physiological weight (2.97, 5.20 & 10.04%) followed by T_7 (3.70, 5.46 & 10.67%) and T_{10} (3.89, 5.73 & 11.01%) on 3rd, 6th and 9th days of storage respectively. However, maximum loss in physiological weight (8.03, 14.52 & 21.43%) was recorded in control treatment on 3rd, 6th and 9th days of storage conditions, respectively.

As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar varieties of guava fruits revealed that significant variation was noticed for physiological loss in weight in both years of experiment. In first year, V_2T_{12} (Chittidar with GA_3 @100 ppm + calcium nitrate @ 2% + potassium sulphate @ 2% treatments exhibited the minimum physiological weight loss (3, 5.12 and 10%) followed by V_1T_{12} (3.02, 5.37 and 10.16%) and V_2T_7 (3.61, 5.36 and 10.20%) on 3rd, 6th and 9th days respectively. However, the maximum physiological weight loss (8.52, 15.68 and 23.55%) was recorded in V_1T_o on 3rd, 6th and 9th days of storage, respectively.

In next year, i.e. 2016-17, treatment V_2T_{12} exhibited the minimum loss in physiological weight (2.92, 5.06 & 9.92%) which was followed by V_1T_{12} (2.95, 5.25 and 10.09%) and V_2T_7 (3.51, 5.38 and 10.12%) on 3rd, 6th and 9th days of storage respectively. While, the maximum value as regards to physiological weight loss (8.84, 15.70 and 24.58%) was registered in V_1T_o on 3rd, 6th and 9th days of storage, respectively.

Table 4.1: Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on physiological loss in weight (%) at 3 day intervals up to 9 days storage

Treatment	Physiological loss in weight (%)											
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
	0 day			3 day			6 day			9 day		
Variety												
V_1	0.00	0.00	0.00	5.08	5.02	5.05	8.02	7.77	7.90	13.32	13.17	13.25
V_2	0.00	0.00	0.00	4.71	4.66	4.68	7.51	7.37	7.44	12.11	12.20	12.16
S.Em. ±	**0.00**	**0.00**	**0.00**	**0.01**	**0.008**	**0.009**	**0.007**	**0.009**	**0.006**	**0.007**	**0.008**	**0.006**
CD (at 5%)	**0.00**	**0.00**	**0.00**	**0.05**	**0.023**	**0.026**	**0.019**	**0.02**	**0.015**	**0.021**	**0.025**	**0.016**
Plant growth regulator and nutrients												
T_0	0.00	0.00	0.00	8.05	8.01	8.03	14.53	14.51	14.52	20.92	21.94	21.43
T_1	0.00	0.00	0.00	5.23	5.23	5.23	8.62	8.02	8.32	13.30	12.85	13.08
T_2	0.00	0.00	0.00	5.13	5.08	5.10	8.29	7.89	8.09	12.63	12.25	12.44
T_3	0.00	0.00	0.00	4.95	4.84	4.90	7.71	7.52	7.62	11.86	11.86	11.86
T_4	0.00	0.00	0.00	4.62	4.55	4.59	6.92	6.83	6.88	11.65	11.65	11.65
T_5	0.00	0.00	0.00	5.88	5.84	5.86	9.09	8.82	8.95	14.08	14.14	14.11
T_6	0.00	0.00	0.00	5.68	5.65	5.66	9.11	8.62	8.86	14.02	14.00	14.01
T_7	0.00	0.00	0.00	3.76	3.64	3.70	5.50	5.42	5.46	10.70	10.63	10.67
T_8	0.00	0.00	0.00	4.98	4.96	4.97	7.94	7.82	7.88	12.43	12.11	12.27
T_9	0.00	0.00	0.00	4.23	4.18	4.21	6.22	6.14	6.18	11.32	11.29	11.31
T_{10}	0.00	0.00	0.00	3.92	3.85	3.89	5.80	5.67	5.73	11.04	10.98	11.01
T_{11}	0.00	0.00	0.00	4.20	4.11	4.15	6.02	5.99	6.01	11.28	11.21	11.25
T_{12}	0.00	0.00	0.00	3.01	2.93	2.97	5.25	5.16	5.20	10.08	10.01	10.04
S.Em.±	**0.00**	**0.00**	**0.00**	**0.04**	**0.02**	**0.024**	**0.01**	**0.02**	**0.014**	**0.01**	**0.02**	**0.014**
CD (at 5%)	**0.00**	**0.00**	**0.00**	**0.12**	**0.06**	**0.067**	**0.05**	**0.06**	**0.039**	**0.05**	**0.06**	**0.040**

Interactions												
V_1T_0	0.00	0.00	0.00	8.52	8.48	8.50	15.68	15.70	15.69	23.55	24.58	24.06
V_1T_1	0.00	0.00	0.00	5.46	5.46	5.46	8.61	8.10	8.36	13.62	12.90	13.26
V_1T_2	0.00	0.00	0.00	5.29	5.22	5.25	8.39	7.92	8.16	13.10	12.26	12.68
V_1T_3	0.00	0.00	0.00	5.02	4.90	4.96	8.10	7.75	7.93	12.17	12.03	12.10
V_1T_4	0.00	0.00	0.00	4.86	4.77	4.82	6.78	6.68	6.73	12.05	11.98	12.02
V_1T_5	0.00	0.00	0.00	6.45	6.39	6.42	9.32	8.94	9.13	15.02	14.98	15.00
V_1T_6	0.00	0.00	0.00	6.08	6.11	6.09	9.42	8.67	9.05	14.99	14.90	14.95
V_1T_7	0.00	0.00	0.00	3.90	3.77	3.84	5.65	5.45	5.55	11.20	11.14	11.17
V_1T_8	0.00	0.00	0.00	5.03	4.98	5.01	7.98	7.82	7.90	12.81	12.12	12.47
V_1T_9	0.00	0.00	0.00	4.22	4.17	4.20	6.52	6.44	6.48	11.62	11.58	11.60
V_1T_{10}	0.00	0.00	0.00	3.96	3.90	3.93	6.09	5.96	6.03	11.26	11.19	11.22
V_1T_{11}	0.00	0.00	0.00	4.19	4.11	4.15	6.40	6.28	6.34	11.58	11.49	11.54
V_1T_{12}	0.00	0.00	0.00	3.02	2.95	2.98	5.37	5.25	5.31	10.16	10.09	10.12
V_2T_0	0.00	0.00	0.00	7.59	7.54	7.57	13.39	13.32	13.36	18.28	19.30	18.79
V_2T_1	0.00	0.00	0.00	5.00	5.00	5.00	8.64	7.94	8.29	12.99	12.81	12.90
V_2T_2	0.00	0.00	0.00	4.96	4.94	4.95	8.18	7.86	8.02	12.15	12.24	12.20
V_2T_3	0.00	0.00	0.00	4.87	4.79	4.83	7.33	7.28	7.31	11.54	11.69	11.62
V_2T_4	0.00	0.00	0.00	4.38	4.33	4.35	7.07	6.99	7.03	11.25	11.32	11.29
V_2T_5	0.00	0.00	0.00	5.32	5.29	5.31	8.85	8.70	8.78	13.14	13.30	13.22
V_2T_6	0.00	0.00	0.00	5.28	5.18	5.23	8.79	8.56	8.68	13.06	13.10	13.08
V_2T_7	0.00	0.00	0.00	3.61	3.51	3.56	5.36	5.38	5.37	10.20	10.12	10.16
V_2T_8	0.00	0.00	0.00	4.93	4.93	4.93	7.90	7.82	7.86	12.05	12.10	12.08
V_2T_9	0.00	0.00	0.00	4.24	4.19	4.22	5.92	5.84	5.88	11.03	11.00	11.01
V_2T_{10}	0.00	0.00	0.00	3.88	3.80	3.84	5.50	5.38	5.44	10.82	10.77	10.79
V_2T_{11}	0.00	0.00	0.00	4.20	4.12	4.16	5.65	5.71	5.68	10.98	10.92	10.95
V_2T_{12}	0.00	0.00	0.00	3.00	2.92	2.96	5.12	5.06	5.09	10.00	9.92	9.96
S.Em. ±	**0.00**	**0.00**	**0.00**	**0.06**	**0.02**	**0.03**	**0.02**	**0.03**	**0.01**	**0.02**	**0.03**	**0.02**
CD (at 5%)	**0.00**	**0.00**	**0.00**	**0.18**	**0.08**	**0.09**	**0.07**	**0.09**	**0.05**	**0.07**	**0.09**	**0.05**

Pooled analysis of the data 2015-16 and 2016-17 revealed that V_2T_{12} recorded minimum loss in physiological weight (2.96, 5.09 & 9.69%) which was followed by V_1T_{12} (2.98, 5.31 and 10.12%) and V_2T_7 (3.56, 5.37 & 10.16%) on 3rd, 6rd & 9th days of storage, respectively. However, maximum losses in physiological weight (8.50, 15.69 and 24.06%) were recorded in V_1T_0 on 3rd, 6rd & 9th days of storage, respectively.

4.2 Decay loss (%) on 6th day and 9th day storage condition

The data showed in Table 4.2 and Fig. 4.10 to 4.15 revealed that minimum decay loss (15.23 and 51.61%) was recorded on 6th and 9th days, respectively in guava variety of Chittidar fruits stored at ambient condition during 2015-2016. In year 2016-17 the minimum decay loss (15.53 & 52.96%) was recorded on 6th and 9th days at storage, respectively in fruits of Chittidar guava.

Pooled analysis of the data 2015-16 and 2016-17 revealed that minimum decay loss (15.38 & 52.28%) on 6th and 9th days of storage, respectively in fruits of Chittidar guava.

Plant growth regulator and nutrients (GA_3, calcium nitrate and potassium sulphate) had significantly minimized the decay loss of guava fruits in both years of experiment. There were none of the decayed fruits had observed in treatments, T_9, T_{10}, T_{11} and T_{12} on 6th days of storage during both year of study. However, maximum decayed fruits noticed under control treatment i.e. T_0. During 2015-16 and 2016-17, lowest decay loss (27.04% & 28.71%) was noticed in T_{12} (GA_3 @100 ppm + calcium nitrate @ 2% + potassium sulphate @ 2%) treatment, respectively which was significantly lowest as compared to other treatments followed by T_7 (28.20 & 29.35%) and T_{10} (32.96 & 33.93%) on 9th day of ambient storage. Pooled analysis of the data of 2015-16 and 2016-17 revealed that minimum decay loss percentage (27.88%) was recorded in T_{12} followed by T_7 (28.77%) and T_{10} (33.44%) on 9th day of storage, respectively. The highest decay loss was recorded in control treatments in both years of study.

As regards to interaction study revealed that significant variation was noticed for decay loss on 6th and 9th days of storage of guava fruits in both years. Treatments, V_2T_9, V_2T_{10}, V_2T_{11} & V_2T_{12} and V_1T_9, V_1T_{10}, V_1T_{11} & V_1T_{12} on 6th day had observed none of the decayed fruits during both years of study,

while maximum decal loss percentage was noticed in control treatments. In the year of 2015-16 indicated that lowest decay loss (26.66%) was noted in V_2T_{12} which was followed by V_2T_7 (26.72%) and V_1T_{12} (27.43%) on 9th day at ambient storage. During 206-17, treatments V_2T_7 registered the lowest value (26.90%) for decay loss percentage which was significantly lowest as compare to other treatments on 9th day of storage which was followed by V_2T_{12} (27.73%) and V_1T_{12} (29.69%). While, the maximum decay loss (92.18%) was recorded in V_2T_0 treatment.

Pooled analysis of the data 2015-16 and 2016-17 revealed that minimum decay loss (26.81%) in V_2T_7 (Chittidar with GA_3 @ 100ppm + calcium nitrate @ 2%) which was followed by (27.19%) in V_2T_{12} (Chittidar with GA_3 @100 ppm + calcium nitrate @ 2%, potassium sulphate @ 2%) and V_1T_{12} (28.56%). However, the maximum decayed fruit (91.22%) were obtained in V_2T_0.

4.3.1 Fruit length (cm) on initial day and 3rd day storage condition

It is pertinent from the data presented in Table 4.3 and Fig.4.16 to 4.27 indicated that fruit length of varieties, plant growth regulator & nutrients was significantly influenced during 2015-16, 2016-17 and pooled analysis right from 0 day to 9th days of storage in present investigation. Fruit length of both varieties was decreased as advancement of storage period. In first year (2015-16), Chittidar variety of guava had recorded maximum fruit length (7.24 & 7.03 cm) on initial day i.e. first day and 3rd day of ambient storage condition. In the next year i.e.2016-17, same trend followed with maximum fruit length (7.36 & 7.16 cm) was recorded in Chittidar guava on initial day and 3rd day of storage. Pooled analysis of data of 2015-16 and 2016-17 revealed that maximum fruit length (7.30 & 7.10 cm) recorded in Chittidar. It has been observed that application of different alone and combined treatments of plant growth regulator and nutrients (GA_3, $Ca(NO_3)_2$ and K_2SO_4) proved beneficial in increasing the length of guava fruits as compare to control however in advancement of storage period fruit length was decreased. In the year of 2015-16 indicated maximum fruit length (7.25 & 7.11 cm) was recorded in T_7 (GA_3 @1000 ppm + calcium nitrate @ 2%) and T_{12} (GA_3 @100 ppm + calcium nitrate @ 2% + potassium sulphate @ 2%) on initial day and 3rd day of storage, respectively which was followed by T_{12} (7.22 cm) & T_7 (7.08 cm) and

T_{10} (7.19 & 7.06 cm) on initial day i.e. zero day and 3rd day of guava fruits storage, respectively. During 2016-17, T_{12} (GA_3 @100 ppm + calcium nitrate @ 2% + potassium sulphate @ 2%) treatment recorded maximum fruit length (7.35 cm and 7.19 cm) followed by T_7 (7.32 & 7.15 cm) and T_{10} (7.28 & 7.13 cm) on initial day and 3rd day of guava fruits storage, respectively. Pooled analysis of the data 2015-16 and 2016-17 revealed that maximum fruit length (7.29 cm) was recorded in T_{12} and T_7 on initial day and T_{12} (7.15 cm) on 3rd day of storage which is statistically significantly best over all the other treatments which was followed by T_{10} treatment (7.23) on initial day T_7 (7.11) on 3rd day of storage, respectively. While, the minimum fruit length was recorded with control treatment write from first day to 9th days of storage. As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4)) alone and in combination of Dharidar & Chittidar varieties of guava fruits revealed that non-significant variations was found in respect to fruit length right from initial day to 9th days of ambient storage condition of guava fruits.

4.3.2 Fruit length (cm) on 6th day and 9th day storage condition

Observation on fruit length had significantly influenced with pre-harvest application of plant growth regulator and nutrients alone and in combination (Table 4.3 and Fig. 4.16 to 4.27). In the first year of experiment i.e. 2015-16, revealed that among two variety of guava, Chittidar variety of guava had recorded maximum fruit length (6.62 & 5.99 cm) on 6th and 9th days of storage. During second year, same trends also observed as Chittidar variety of guava show the maximum fruit length (6.70 & 6.08 cm) on 6th and 9th days of ambient storage respectively. Pooled analysis of the data 2015-16 and 2016-17 revealed that guava variety Chittidar had maximum fruit length (6.66 & 6.04 cm).

Table 4.2: Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on decay loss (%) at 3 day intervals up to 9 days storage

Treatment	Decay loss (%)											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Variety												
V_1	0.00	0.00	0.00	0.00	0.00	0.00	15.88	17.55	16.72	52.56	54.67	53.61
V_2	0.00	0.00	0.00	0.00	0.00	0.00	15.23	15.53	15.38	51.61	52.96	52.28
S.Em.±	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.014**	**0.011**	**0.02**	**0.03**	**0.02**
CD (at 5%)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.04**	**0.04**	**0.030**	**0.06**	**0.09**	**0.05**
Plant growth regulator and nutrients												
T_0	0.00	0.00	0.00	0.00	0.00	0.00	63.48	65.90	64.69	90.67	91.13	90.90
T_1	0.00	0.00	0.00	0.00	0.00	0.00	18.75	20.30	19.53	58.65	60.73	59.69
T_2	0.00	0.00	0.00	0.00	0.00	0.00	13.38	14.72	14.05	54.53	58.48	56.50
T_3	0.00	0.00	0.00	0.00	0.00	0.00	9.90	11.12	10.51	49.95	51.71	50.83
T_4	0.00	0.00	0.00	0.00	0.00	0.00	3.32	4.16	3.74	43.26	44.96	44.11
T_5	0.00	0.00	0.00	0.00	0.00	0.00	41.14	42.17	41.66	81.65	83.11	82.38
T_6	0.00	0.00	0.00	0.00	0.00	0.00	40.18	41.74	40.96	80.90	82.76	81.83
T_7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.20	29.35	28.77
T_8	0.00	0.00	0.00	0.00	0.00	0.00	12.04	14.94	13.49	51.81	54.18	52.99
T_9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	40.22	41.04	40.63
T_{10}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.96	33.93	33.44
T_{11}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.22	39.52	38.37
T_{12}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.04	28.71	27.88
S.Em. ±	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.04**	**0.03**	**0.02**	**0.05**	**0.08**	**0.04**
CD (at 5%)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.12**	**0.10**	**0.07**	**0.15**	**0.22**	**0.12**

Interactions												
V_1T_0	0.00	0.00	0.00	0.00	0.00	0.00	64.61	66.82	65.71	91.08	90.08	90.58
V_1T_1	0.00	0.00	0.00	0.00	0.00	0.00	19.36	22.10	20.73	59.27	62.40	60.83
V_1T_2	0.00	0.00	0.00	0.00	0.00	0.00	14.86	17.32	16.09	54.06	58.56	56.31
V_1T_3	0.00	0.00	0.00	0.00	0.00	0.00	10.18	12.36	11.27	50.12	53.23	51.68
V_1T_4	0.00	0.00	0.00	0.00	0.00	0.00	3.60	5.34	4.47	43.56	46.38	44.97
V_1T_5	0.00	0.00	0.00	0.00	0.00	0.00	40.92	42.98	41.95	82.00	83.68	82.84
V_1T_6	0.00	0.00	0.00	0.00	0.00	0.00	39.68	42.90	41.29	81.24	83.10	82.17
V_1T_7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.68	31.80	30.74
V_1T_8	0.00	0.00	0.00	0.00	0.00	0.00	13.22	18.37	15.80	52.16	54.00	53.08
V_1T_9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.08	41.22	40.15
V_1T_{10}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.36	36.16	35.76
V_1T_{11}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.18	40.43	39.31
V_1T_{12}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.43	29.69	28.56
V_2T_0	0.00	0.00	0.00	0.00	0.00	0.00	62.36	64.98	63.67	90.26	92.18	91.22
V_2T_1	0.00	0.00	0.00	0.00	0.00	0.00	18.14	18.52	18.33	58.03	59.06	58.55
V_2T_2	0.00	0.00	0.00	0.00	0.00	0.00	11.90	12.12	12.01	55.00	58.40	56.70
V_2T_3	0.00	0.00	0.00	0.00	0.00	0.00	9.63	9.88	9.75	49.78	50.19	49.99
V_2T_4	0.00	0.00	0.00	0.00	0.00	0.00	3.06	2.98	3.02	42.96	43.54	43.25
V_2T_5	0.00	0.00	0.00	0.00	0.00	0.00	41.36	41.36	41.36	81.29	82.53	81.91
V_2T_6	0.00	0.00	0.00	0.00	0.00	0.00	40.69	40.58	40.64	80.56	82.42	81.49
V_2T_7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.72	26.90	26.81
V_2T_8	0.00	0.00	0.00	0.00	0.00	0.00	10.86	11.52	11.19	51.46	54.36	52.91
V_2T_9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.36	40.86	41.11
V_2T_{10}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.56	31.69	31.12
V_2T_{11}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.26	38.61	37.43
V_2T_{12}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.66	27.73	27.19
S.Em. ±	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.06**	**0.05**	**0.04**	**0.07**	**0.11**	**0.06**
CD (at 5%)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.18**	**0.15**	**0.11**	**0.21**	**0.32**	**0.17**

In the year of 2015-16, T_{12} (GA_3 @100ppm + calcium nitrate @ 2% + potassium sulphate @ 2%) treatment recorded maximum fruit length (6.79 and 6.23 cm) on 6^{th} and 9^{th} days at ambient storage condition which was followed by T_7 (6.75 and 6.17 cm) and T_{10} (6.69 and 6.11 cm). In the following year i.e.2016-17, T_{12} had recorded maximum fruit length (6.87 and 6.31 cm) on 6^{th} and 9^{th} days at ambient storage condition followed by T_7 (6.81 and 6.25 cm) and T_{10} (6.76 and 6.20 cm) on 6^{th} and 9^{th} days of guava fruits storage, respectively. The minimum value as regards to fruit length was recorded in control treatment in both years up to 9^{th} days of storage.

Pooled analysis of data of 2015-16 and 2016-17 revealed that maximum fruit length (6.83 and 6.27 cm) was noted in T_{12} on 6^{th} and 9^{th} days at ambient storage condition, respectively which is statistically significant best over all the other treatments followed by T_7 (6.78 and 6.21 cm) and T_{10} (6.73 and 6.15 cm) on 6^{th} and 9^{th} days of storage, respectively. However, the minimum fruit length (6.18 and 5.44 cm) was recorded with T_0 on 6^{th} and 9^{th} days of storage, respectively.

4.4.1 Fruit diameter (cm) on initial day and 3rd day storage condition

It is clear from the data presented in Table 4.4 and Fig.4.28 to 4.39 indicated that fruit diameter of both varieties, plant growth regulator & nutrients was significantly influenced during 2015-16, 2016-17 and pooled analysis right from first day to 9^{th} day of ambient storage condition in present investigation. Fruit diameter of both varieties was decreased with advancement of storage period. In first year, Dharidar variety of guava had recorded maximum fruit diameter (7.78 & 7.48 cm) on initial day and 3^{rd} day of ambient storage condition. In the following yeari.e.2016-17, same trend followed with maximum fruit diameter (7.82 & 7.51 cm) was recorded in Dharidar guava on zero day and 3^{rd} day of storage. Pooled analysis of data of 2015-16 and 2016-17 revealed that maximum diameter (7.80 & 7.50 cm) recorded in guava variety of Dharidar.

It has been observed that the application of different alone and combined treatments of plant growth regulator and nutrients (GA_3, calcium nitrate and potassium sulphate) proved beneficial in increasing the diameter

of guava fruits as compare to control treatment. In the year of 2015-16 indicated maximum fruit diameter (7.47 and 7.17cm) was noticed under T_{12} (GA3 @1000 ppm + calcium nitrate @ 2%+ potassium sulphate @ 2%) on initial day and 3rd day of storage, respectively which was followed by T_7 (7.44 & 7.15 cm) and T_{10} (7.42 & 7.13 cm) on initial day i.e. zero day and 3rd day of storage, respectively. During 2016-17, treatment T_{12} (GA_3 @100ppm + calcium nitrate @ 2% + potassium sulphate @2%) treatment recorded maximum fruit diameter (7.51 & 7.21 cm) followed by T_7 (7.48 and 7.19 cm) and T_{10} (7.45 and 7.16 cm) on first day and 3rd day of guava fruits storage, respectively. Pooled analysis of the data 2015-16 and 2016-17 revealed that maximum fruit diameter (7.49 and 7.19 cm) was recorded in T_{12} on initial day and 3rd day of storage which is statistically significantly best over all the other treatments which was followed by T_7 treatment (7.46 and 7.17 cm) and T_{10} (7.43 and 7.15 cm) on initial day and 3rd day of storage, respectively. The minimum value as regards to fruit diameter was recorded in control treatment in both years up to 9th days at storage. As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {Ca $(NO_3)_2$} & potassium sulphate (K_2SO_4)) alone and in combination with Dharidar & Chittidar varieties of guava fruits revealed that non-significant variations was found in respect to fruit diameter right from initial day to 9th days of ambient storage condition of guava fruits.

4.4.2 Fruit diameter (cm) on 6th day and 9th day storage condition

Observation on fruit diameter had significantly influenced with pre-harvest application of plant growth regulator and nutrients alone and in combination. In the first year of experiment i.e. 2015-16, revealed that among two variety of guava, Dharidar variety of guava had recorded maximum fruit diameter (7.10 and 6.50 cm) on 6th and 9th days of storage. During 2016-17, same trends also followed as in Dharidar variety of guava show the maximum fruit diameter (7.15 and 6.54 cm) on 6th and 9th days of ambient storage respectively. Pooled analysis of the data 2015-16 and 2016-17 revealed that guava variety Dharidar had found maximum fruit length (7.12 and 6.52 cm) on 6th and 9th days at storage, respectively.

Table 4.3: Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit length (cm) at 3 day intervals up to 9 days storage

Treatments	Fruit length (cm)											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	6.90	6.98	6.94	6.75	6.79	6.77	6.33	6.39	6.36	5.70	5.75	5.72
V_2	7.24	7.36	7.30	7.03	7.16	7.10	6.62	6.70	6.66	5.99	6.08	6.04
S.Em. ±	**0.005**	**0.01**	**0.007**	**0.005**	**0.006**	**0.004**	**0.008**	**0.008**	**0.005**	**0.004**	**0.005**	**0.003**
CD (at 5%)	**0.010**	**0.03**	**0.020**	**0.01**	**0.01**	**0.012**	**0.022**	**0.023**	**0.015**	**0.01**	**0.01**	**0.009**
Plant growth regulator and nutrients												
T_0	6.89	6.98	6.93	6.64	6.73	6.69	6.13	6.23	6.18	5.40	5.49	5.44
T_1	6.99	7.09	7.04	6.81	6.90	6.86	6.36	6.38	6.37	5.67	5.74	5.71
T_2	7.01	7.11	7.06	6.83	6.91	6.87	6.38	6.45	6.41	5.74	5.79	5.77
T_3	7.06	7.14	7.10	6.88	6.97	6.92	6.46	6.54	6.50	5.84	5.89	5.87
T_4	7.09	7.17	7.13	6.92	7.01	6.96	6.51	6.59	6.55	5.91	5.96	5.94
T_5	6.93	7.07	7.00	6.70	6.82	6.76	6.22	6.30	6.26	5.53	5.61	5.57
T_6	6.96	7.08	7.02	6.72	6.84	6.78	6.26	6.33	6.30	5.55	5.63	5.59
T_7	7.25	7.32	7.29	7.08	7.15	7.11	6.75	6.81	6.78	6.17	6.25	6.21
T_8	7.05	7.13	7.09	6.87	6.92	6.89	6.40	6.47	6.44	5.77	5.83	5.80
T_9	7.13	7.21	7.17	6.98	7.05	7.01	6.58	6.67	6.62	6.01	6.07	6.04
T_{10}	7.19	7.28	7.23	7.06	7.13	7.10	6.69	6.76	6.73	6.11	6.20	6.15
T_{11}	7.17	7.24	7.21	7.02	7.08	7.05	6.64	6.71	6.68	6.05	6.14	6.09
T_{12}	7.22	7.35	7.29	7.11	7.19	7.15	6.79	6.87	6.83	6.23	6.31	6.27
S.Em. ±	**0.01**	**0.03**	**0.018**	**0.01**	**0.01**	**0.011**	**0.02**	**0.02**	**0.01**	**0.01**	**0.01**	**0.008**
CD (at 5%)	**0.04**	**0.09**	**0.050**	**0.04**	**0.04**	**0.031**	**0.06**	**0.06**	**0.04**	**0.03**	**0.03**	**0.024**

Interactions												
V_1T_0	6.68	6.77	6.73	6.50	6.58	6.54	6.00	6.08	6.04	5.26	5.30	5.28
V_1T_1	6.86	6.89	6.87	6.67	6.69	6.68	6.22	6.23	6.23	5.52	5.58	5.55
V_1T_2	6.88	6.92	6.90	6.69	6.70	6.70	6.25	6.29	6.27	5.60	5.65	5.62
V_1T_3	6.90	6.95	6.92	6.75	6.78	6.77	6.31	6.38	6.35	5.70	5.76	5.73
V_1T_4	6.92	6.97	6.95	6.78	6.82	6.80	6.36	6.45	6.41	5.76	5.80	5.78
V_1T_5	6.80	6.90	6.85	6.59	6.63	6.61	6.08	6.16	6.12	5.38	5.43	5.41
V_1T_6	6.82	6.91	6.86	6.60	6.65	6.63	6.12	6.18	6.15	5.40	5.46	5.43
V_1T_7	7.10	7.14	7.12	6.92	6.94	6.93	6.59	6.64	6.62	6.01	6.08	6.05
V_1T_8	6.89	6.94	6.91	6.74	6.72	6.73	6.26	6.32	6.29	5.63	5.70	5.67
V_1T_9	6.95	7.02	6.99	6.83	6.87	6.85	6.43	6.51	6.47	5.87	5.90	5.89
V_1T_{10}	7.00	7.09	7.04	6.90	6.96	6.93	6.54	6.60	6.57	5.96	6.02	5.99
V_1T_{11}	6.98	7.06	7.02	6.87	6.90	6.88	6.49	6.56	6.52	5.90	5.96	5.93
V_1T_{12}	7.10	7.18	7.14	6.95	7.02	6.99	6.63	6.69	6.66	6.07	6.13	6.10
V_2T_0	7.09	7.21	7.15	6.78	6.89	6.83	6.26	6.37	6.32	5.53	5.67	5.60
V_2T_1	7.13	7.30	7.21	6.95	7.10	7.03	6.50	6.52	6.51	5.82	5.90	5.86
V_2T_2	7.15	7.30	7.22	6.96	7.11	7.04	6.52	6.60	6.56	5.88	5.94	5.91
V_2T_3	7.21	7.34	7.28	7.00	7.16	7.08	6.60	6.69	6.65	5.98	6.02	6.00
V_2T_4	7.27	7.37	7.32	7.06	7.19	7.13	6.66	6.74	6.70	6.06	6.12	6.09
V_2T_5	7.06	7.23	7.15	6.81	7.01	6.91	6.36	6.44	6.40	5.68	5.78	5.73
V_2T_6	7.09	7.25	7.17	6.83	7.03	6.93	6.40	6.48	6.44	5.70	5.80	5.75
V_2T_7	7.40	7.50	7.45	7.24	7.35	7.30	6.90	6.98	6.94	6.33	6.43	6.38
V_2T_8	7.20	7.33	7.27	6.99	7.12	7.06	6.54	6.62	6.58	5.92	5.96	5.94
V_2T_9	7.30	7.40	7.35	7.12	7.22	7.17	6.73	6.82	6.77	6.16	6.24	6.20
V_2T_{10}	7.38	7.47	7.43	7.22	7.29	7.26	6.84	6.92	6.88	6.26	6.38	6.32
V_2T_{11}	7.35	7.43	7.39	7.17	7.26	7.22	6.79	6.87	6.83	6.21	6.31	6.26
V_2T_{12}	7.44	7.53	7.48	7.26	7.36	7.31	6.95	7.05	7.00	6.39	6.49	6.44
S.Em. ±	**0.02**	**0.04**	**0.02**	**0.02**	**0.02**	**0.01**	**0.03**	**0.03**	**0.02**	**0.01**	**0.01**	**0.01**
CD (at 5%)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

In the year of 2015-16, T_{12} (GA_3 @100ppm + calcium nitrate @ 2% + potassium sulphate @ 2%) treatment recorded maximum fruit diameter (6.86 cm and 6.30 cm) on 6th and 9th days at ambient storage condition which was followed by T_7 (6.83 and 6.27 cm) and T_{10} (6.80 and 6.22 cm). In the following year i.e.2016-17, maximum fruit diameter (6.88 and 6.31 cm) on 6th and 9th days at ambient storage condition followed by T_7 (6.86 and 6.28 cm) and T_{10} (6.83 and 6.23 cm) on 6th and 9th days at ambient storage condition, respectively. Pooled analysis of data of 2015-16 and 2016-17 revealed that maximum fruit diameter (6.87 and 6.30 cm) was noted on 6th and 9th days at ambient storage condition, respectively which is statistically significant best over all the other treatments followed by T_7 (6.85 and 6.27 cm) and T_{10} (6.82 and 6.22 cm) on 6th and 9th days storage guava fruits at ambient condition, respectively.

4.5.1 Specific gravity on initial day and 3rd day storage condition

Perusals of data presented in Table 4.5 and Fig. 4.40 to 4.51clearly indicated that specific gravity of guava varieties was significantly influenced by plant growth regulator & nutrients during both year of experiment. In the year of 2015-16, maximum specific gravity (0.96) and (0.93) was noticed with Chittidar variety of guava on initial day and 3rd day at storage condition, respectively. During the year of 2016-17, maximum specific gravity (0.96) and (0.94) was noticed with Chittidar guava on initial day and 3rd day at storage condition respectively. Pooled analysis of data of 2015-16 and 2016-17 revealed that maximum specific gravity (0.96) and (0.94) was noticed in Chittidar (V_2) on initial day and 3rd day at storage condition, respectively. In the year of 2015-16, T_{12} (GA_3 @100ppm + calcium nitrate @ 2% + potassium sulphate @ 2%) treatment recorded maximum specific gravity (1.00) and (0.99) on initial day and 3rd day at storage condition, respectively which was followed by T_7 (0.98) and (0.97) on initial day and 3rd day at storage condition, respectively. On initial day minimum specific gravity (0.89) was noted in T_5 and on 3rd days and minimum specific gravity (0.87) was recorded in T_0 & T_5. The next year i.e.2016-17, maximum specific gravity (1.01) and (1.00) was

recorded in T_{12} which was followed by (1.00) and (0.98) on initial day and 3rd at storage condition respectively. On initial day minimum specific gravity (0.89) was noted in T_5 & T_6 and on 3rd days minimum specific gravity (0.88) was recorded in T_o, T_5 & T_6. Pooled analysis of data of 2015-16 and 2016-17 revealed that maximum specific gravity (1.01 & 0.99) was noted in T_{12} which is significant best over all the other treatments followed by T_7 (0.99) and (0.97) on initial day and 3rd day at storage condition respectively. However, minimum specific gravity (0.89) and (0.87) was recorded in T_5 and T_0 on initial day and 3rd days at storage respectively.

4.5.2 Specific gravity on 6th and 9th day storage condition

In both years of experiment i.e. 2015-16 & 2016-17, revealed that among two variety of guava, Chittidar variety had recorded maximum specific gravity (0.91) on 6th day of storage. Specific gravity on 9th day of guava fruits storage was found non-significant.

As regards to gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) alone and in combination, same trends was observed as in initial day and 3rd day at storage condition, however pooled data of both years indicated that T_{12} (GA_3 @100ppm + calcium nitrate @ 2% + potassium sulphate @ 2%) treatment recorded maximum specific gravity (0.97) and (0.95) on 6th and 9th days at storage condition which was followed by T_7 (0.95) & (0.93) on 6th and 9th days at storage condition. Whereas, minimum specific gravity (0.86) & (0.82) on 6th and 9th days at storage condition was recorded with control treatment.

Interaction study of gibberellic acid (GA_3), calcium nitrate {Ca $(NO_3)_2$} & potassium sulphate (K_2SO_4) alone and in combination with Dharidar & Chittidar varieties of guava fruits revealed that non-significant variations was found in respect to specific gravity right from initial days to 9th days of ambient storage condition of guava fruits.

Table 4.4: Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit diameter (cm) at 3 day intervals up to 9 days storage

Treatments	Fruit diameter (cm)											
	0 day			3 day			6 day			9 day		
	2015-2016	2016-2017	Pooled	2015-2016	2016-2017	Pooled	2015-2016	2016-2017	Pooled	2015-2016	2016-2017	Pooled
Varieties												
V_1	7.78	7.82	7.80	7.48	7.51	7.50	7.10	7.15	7.12	6.50	6.54	6.52
V_2	6.85	6.86	6.86	6.56	6.59	6.57	6.19	6.19	6.19	5.56	5.50	5.53
S.Em. ±	**0.007**	**0.01**	**0.006**	**0.004**	**0.006**	**0.004**	**0.007**	**0.008**	**0.006**	**0.005**	**0.009**	**0.005**
CD (at 5%)	**0.02**	**0.02**	**0.017**	**0.01**	**0.01**	**0.012**	**0.02**	**0.02**	**0.016**	**0.01**	**0.02**	**0.015**
Plant growth regulator and nutrients												
T_0	7.18	7.20	7.19	6.89	6.90	6.89	6.37	6.36	6.36	5.66	5.66	5.66
T_1	7.26	7.28	7.27	6.96	6.98	6.97	6.56	6.61	6.59	5.93	5.92	5.92
T_2	7.26	7.29	7.27	6.97	6.99	6.98	6.60	6.63	6.62	5.98	5.96	5.97
T_3	7.30	7.33	7.31	7.00	7.03	7.02	6.65	6.68	6.66	6.06	6.03	6.05
T_4	7.32	7.35	7.34	7.02	7.05	7.04	6.68	6.71	6.69	6.10	6.08	6.09
T_5	7.21	7.22	7.21	6.92	6.94	6.93	6.45	6.46	6.45	5.76	5.75	5.76
T_6	7.22	7.23	7.23	6.93	6.96	6.94	6.46	6.47	6.47	5.78	5.77	5.77
T_7	7.44	7.48	7.46	7.15	7.19	7.17	6.83	6.86	6.85	6.27	6.28	6.27
T_8	7.28	7.30	7.29	6.98	6.99	6.99	6.62	6.64	6.63	5.99	5.97	5.98
T_9	7.37	7.39	7.38	7.08	7.10	7.09	6.74	6.77	6.75	6.16	6.14	6.15
T_{10}	7.42	7.45	7.43	7.13	7.16	7.15	6.80	6.83	6.82	6.22	6.23	6.22
T_{11}	7.40	7.43	7.41	7.11	7.13	7.12	6.77	6.80	6.78	6.19	6.19	6.19
T_{12}	7.47	7.51	7.49	7.17	7.21	7.19	6.86	6.88	6.87	6.30	6.31	6.30
S.Em. ±	**0.01**	**0.02**	**0.015**	**0.01**	**0.01**	**0.011**	**0.02**	**0.02**	**0.014**	**0.01**	**0.02**	**0.013**
CD (at 5%)	**0.05**	**0.07**	**0.043**	**0.03**	**0.04**	**0.031**	**0.05**	**0.06**	**0.040**	**0.04**	**0.06**	**0.037**

Interactions												
V_1T_0	7.65	7.68	7.67	7.35	7.38	7.37	6.82	6.84	6.83	6.13	6.18	6.15
V_1T_1	7.72	7.76	7.74	7.42	7.44	7.43	7.00	7.08	7.04	6.40	6.44	6.42
V_1T_2	7.72	7.77	7.75	7.43	7.46	7.45	7.05	7.11	7.08	6.45	6.49	6.47
V_1T_3	7.76	7.80	7.78	7.46	7.48	7.47	7.11	7.16	7.13	6.53	6.57	6.55
V_1T_4	7.78	7.83	7.81	7.48	7.50	7.49	7.14	7.19	7.16	6.57	6.60	6.59
V_1T_5	7.69	7.70	7.70	7.40	7.40	7.40	6.90	6.93	6.92	6.22	6.27	6.25
V_1T_6	7.70	7.72	7.71	7.40	7.42	7.41	6.91	6.94	6.93	6.24	6.29	6.27
V_1T_7	7.92	7.96	7.94	7.61	7.64	7.63	7.29	7.34	7.31	6.73	6.79	6.76
V_1T_8	7.74	7.78	7.76	7.44	7.46	7.45	7.06	7.12	7.09	6.46	6.50	6.48
V_1T_9	7.83	7.86	7.85	7.53	7.55	7.54	7.19	7.25	7.22	6.62	6.67	6.65
V_1T_{10}	7.89	7.92	7.90	7.58	7.61	7.60	7.26	7.31	7.28	6.69	6.74	6.72
V_1T_{11}	7.86	7.90	7.88	7.56	7.57	7.57	7.22	7.27	7.25	6.66	6.71	6.68
V_1T_{12}	7.94	7.98	7.96	7.63	7.67	7.65	7.32	7.36	7.34	6.76	6.82	6.79
V_2T_0	6.70	6.72	6.71	6.43	6.41	6.42	5.91	5.89	5.90	5.19	5.14	5.16
V_2T_1	6.79	6.79	6.79	6.50	6.52	6.51	6.13	6.14	6.14	5.45	5.39	5.42
V_2T_2	6.79	6.81	6.80	6.52	6.53	6.52	6.16	6.15	6.16	5.50	5.43	5.47
V_2T_3	6.84	6.85	6.85	6.55	6.58	6.56	6.19	6.20	6.20	5.59	5.50	5.55
V_2T_4	6.86	6.87	6.87	6.57	6.60	6.58	6.22	6.23	6.23	5.62	5.55	5.59
V_2T_5	6.72	6.73	6.73	6.43	6.48	6.46	6.00	5.98	5.99	5.30	5.23	5.27
V_2T_6	6.73	6.74	6.74	6.45	6.49	6.47	6.01	6.00	6.01	5.32	5.25	5.28
V_2T_7	6.97	7.01	6.99	6.69	6.73	6.71	6.38	6.39	6.39	5.81	5.76	5.79
V_2T_8	6.82	6.82	6.82	6.53	6.53	6.53	6.18	6.16	6.17	5.52	5.44	5.48
V_2T_9	6.90	6.92	6.91	6.62	6.65	6.63	6.28	6.29	6.28	5.69	5.61	5.65
V_2T_{10}	6.95	6.98	6.97	6.68	6.71	6.70	6.35	6.36	6.35	5.76	5.71	5.73
V_2T_{11}	6.93	6.95	6.94	6.65	6.68	6.66	6.31	6.32	6.32	5.72	5.67	5.70
V_2T_{12}	7.00	7.04	7.02	6.71	6.75	6.73	6.40	6.41	6.40	5.84	5.79	5.82
S.Em. ±	**0.02**	**0.03**	**0.02**	**0.01**	**0.02**	**0.01**	**0.02**	**0.03**	**0.02**	**0.02**	**0.03**	**0.01**
CD (at 5%)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Table 4.5: Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on specific gravity at 3 day intervals up to 9 days storage

Treatments	Specific gravity											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	0.92	0.92	0.92	0.91	0.91	0.91	0.89	0.90	0.90	0.87	0.88	0.88
V_2	0.96	0.96	0.96	0.93	0.94	0.94	0.91	0.91	0.91	0.88	0.89	0.88
S.Em. ±	**0.005**	**0.004**	**0.003**	**0.005**	**0.004**	**0.003**	**0.004**	**0.004**	**0.003**	**0.005**	**0.004**	**0.004**
CD (at 5%)	**0.01**	**0.01**	**0.009**	**0.01**	**0.01**	**0.009**	**0.01**	**0.01**	**0.008**	**NS**	**NS**	**NS**
Plant growth regulator and nutrients												
T_0	0.91	0.90	0.91	0.87	0.88	0.87	0.85	0.86	0.86	0.82	0.82	0.82
T_1	0.91	0.92	0.92	0.90	0.91	0.90	0.87	0.88	0.87	0.85	0.86	0.85
T_2	0.92	0.93	0.92	0.91	0.91	0.91	0.88	0.90	0.89	0.85	0.86	0.86
T_3	0.93	0.93	0.93	0.92	0.93	0.92	0.88	0.90	0.89	0.87	0.88	0.87
T_4	0.94	0.96	0.95	0.93	0.93	0.93	0.90	0.91	0.90	0.88	0.88	0.88
T_5	0.89	0.89	0.89	0.87	0.88	0.88	0.86	0.86	0.86	0.83	0.84	0.84
T_6	0.91	0.89	0.90	0.89	0.88	0.88	0.86	0.86	0.86	0.84	0.85	0.84
T_7	0.98	1.00	0.99	0.97	0.98	0.97	0.95	0.95	0.95	0.93	0.93	0.93
T_8	0.92	0.93	0.92	0.91	0.91	0.91	0.88	0.90	0.89	0.86	0.87	0.87
T_9	0.95	0.97	0.96	0.95	0.93	0.94	0.92	0.93	0.93	0.90	0.90	0.90
T_{10}	0.97	0.98	0.97	0.96	0.96	0.96	0.94	0.95	0.95	0.92	0.92	0.92
T_{11}	0.97	0.98	0.97	0.94	0.95	0.95	0.94	0.94	0.94	0.90	0.92	0.91
T_{12}	1.00	1.01	1.01	0.99	1.00	0.99	0.97	0.98	0.97	0.94	0.95	0.95
S.Em. ±	**0.01**	**0.01**	**0.008**	**0.01**	**0.01**	**0.008**	**0.01**	**0.01**	**0.008**	**0.01**	**0.01**	**0.009**
CD (at 5%)	**0.03**	**0.03**	**0.023**	**0.03**	**0.03**	**0.87**	**0.03**	**0.03**	**0.022**	**0.04**	**0.03**	**0.025**

Interactions												
V_1T_0	0.89	0.88	0.89	0.86	0.87	0.87	0.84	0.85	0.85	0.82	0.83	0.83
V_1T_1	0.89	0.89	0.89	0.88	0.89	0.89	0.86	0.88	0.87	0.85	0.85	0.85
V_1T_2	0.90	0.91	0.90	0.89	0.90	0.90	0.87	0.89	0.88	0.85	0.86	0.85
V_1T_3	0.91	0.91	0.91	0.90	0.91	0.91	0.87	0.89	0.88	0.86	0.87	0.87
V_1T_4	0.92	0.94	0.93	0.91	0.91	0.91	0.89	0.90	0.90	0.87	0.87	0.87
V_1T_5	0.88	0.87	0.88	0.87	0.87	0.87	0.85	0.85	0.85	0.83	0.84	0.84
V_1T_6	0.88	0.87	0.87	0.88	0.87	0.88	0.85	0.86	0.85	0.84	0.84	0.84
V_1T_7	0.96	0.97	0.97	0.95	0.96	0.96	0.94	0.94	0.94	0.92	0.92	0.92
V_1T_8	0.90	0.91	0.90	0.89	0.90	0.90	0.87	0.89	0.88	0.86	0.86	0.86
V_1T_9	0.93	0.95	0.94	0.94	0.91	0.93	0.91	0.92	0.92	0.90	0.89	0.90
V_1T_{10}	0.96	0.96	0.96	0.94	0.94	0.94	0.93	0.94	0.93	0.91	0.91	0.91
V_1T_{11}	0.95	0.96	0.96	0.92	0.93	0.93	0.93	0.94	0.93	0.90	0.91	0.91
V_1T_{12}	0.98	0.99	0.99	0.97	0.98	0.98	0.95	0.96	0.96	0.93	0.94	0.94
V_2T_0	0.93	0.91	0.92	0.87	0.88	0.88	0.86	0.87	0.87	0.82	0.81	0.82
V_2T_1	0.93	0.94	0.94	0.91	0.92	0.92	0.87	0.88	0.88	0.85	0.86	0.86
V_2T_2	0.93	0.94	0.94	0.92	0.92	0.92	0.89	0.90	0.90	0.86	0.87	0.86
V_2T_3	0.94	0.95	0.95	0.93	0.94	0.94	0.89	0.90	0.90	0.87	0.88	0.88
V_2T_4	0.96	0.97	0.97	0.94	0.95	0.95	0.90	0.91	0.91	0.88	0.89	0.89
V_2T_5	0.89	0.90	0.90	0.87	0.88	0.88	0.86	0.86	0.86	0.83	0.84	0.84
V_2T_6	0.93	0.90	0.92	0.89	0.88	0.89	0.86	0.86	0.86	0.84	0.85	0.85
V_2T_7	1.00	1.02	1.01	0.98	0.99	0.99	0.96	0.96	0.96	0.93	0.93	0.93
V_2T_8	0.94	0.95	0.95	0.92	0.92	0.92	0.89	0.90	0.90	0.86	0.88	0.87
V_2T_9	0.97	0.98	0.98	0.95	0.95	0.95	0.93	0.93	0.93	0.90	0.91	0.91
V_2T_{10}	0.98	0.99	0.99	0.97	0.97	0.97	0.95	0.96	0.96	0.92	0.92	0.92
V_2T_{11}	0.98	0.99	0.99	0.96	0.97	0.97	0.94	0.94	0.94	0.90	0.92	0.91
V_2T_{12}	1.02	1.03	1.03	1.01	1.02	1.01	0.98	0.99	0.99	0.95	0.96	0.96
S.Em. ±	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
CD (at 5%)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

4.6.1 Marketable fruits (%) at 6th day storage condition

Observation on marketable fruits had significantly influenced with pre-harvest application of plant growth regulator and nutrients alone and in combination (Table 4.6 and Fig. 4.52 to 4.57). In the year 2015-16 & 2016-17and pooled analysis ,revealed that among two variety of guava, Dharidar variety of guava had obtained maximum marketable fruits (84.77%) & (84.47%) and (84.62%) on 6th day at storage condition, respectively.

It has been observed that the application of different alone and combined treatments of plant growth regulator and nutrients (GA_3, calcium nitrate and potassium sulphate) proved beneficial effect in obtaining the maximum percentage of marketable fruits. Hundred per cent of marketable fruit was obtained from T_7, T_9, T_{10}, T_{11} and T_{12}. However, in rest of treatments maximum marketable fruits was procured with T_4 (96.26%) which was followed by T_3 (89.49%) and T_8 (86.51). Whenever, minimum marketable fruits (34.10%) were obtained in control treatment.

As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar varieties of guava fruits revealed that significant variation was noticed for marketable fruit percentage in two years experiment. Hundred per cent of marketable fruit was obtained from V_1T_7, V_1T_9, V_1T_{10}, V_1T_{11} & V_1T_{12} and V_2T_7, V_2T_9, V_1T_{10}, V_2T_{11} & V_2T_{12}. However, in rest of treatments maximum marketable fruits (96.94, 97.02 & 96.98%) were procured with V_2T_4. Minimum marketable fruits (35.39, 33.18 & 34.29%) were obtained in V_1T_0 in both years of experiments.

Table 4.6: Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on marketable fruits (%) at 3 day intervals up to 9 days storage

Treatments	Marketable fruits (%)											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	100	100	100	100	100	100	84.12	82.45	83.28	47.44	45.33	46.39
V_2	100	100	100	100	100	100	84.77	84.47	84.62	48.39	47.04	47.72
S.Em. ±	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.017**	**0.014**	**0.011**	**0.020**	**0.031**	**0.017**
CD (at 5%)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.049**	**0.040**	**0.030**	**0.058**	**0.088**	**0.048**
Plant growth regulator and nutrients												
T_0	100	100	100	100	100	100	36.52	34.10	35.31	9.33	8.87	9.10
T_1	100	100	100	100	100	100	81.25	79.69	80.47	41.35	39.27	40.31
T_2	100	100	100	100	100	100	86.62	85.28	85.95	45.47	41.52	43.50
T_3	100	100	100	100	100	100	90.10	88.88	89.49	50.05	48.29	49.17
T_4	100	100	100	100	100	100	96.67	95.84	96.26	56.74	55.04	55.89
T_5	100	100	100	100	100	100	58.86	57.83	58.34	18.36	16.89	17.62
T_6	100	100	100	100	100	100	59.81	58.26	59.04	19.10	17.24	18.17
T_7	100	100	100	100	100	100	100.00	100.00	100.00	71.80	70.65	71.23
T_8	100	100	100	100	100	100	87.96	85.06	86.51	48.19	45.82	47.01
T_9	100	100	100	100	100	100	100.00	100.00	100.00	59.78	58.96	59.37
T_{10}	100	100	100	100	100	100	100.00	100.00	100.00	67.04	66.07	66.56
T_{11}	100	100	100	100	100	100	100.00	100.00	100.00	62.78	60.48	61.63
T_{12}	100	100	100	100	100	100	100.00	100.00	100.00	72.96	71.29	72.13
S.Em. ±	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.04**	**0.04**	**0.03**	**0.05**	**0.08**	**0.04**
CD (at 5%)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.12**	**0.10**	**0.08**	**0.15**	**0.22**	**0.12**

Interactions												
V_1T_0	100	100	100	100	100	100	35.39	33.18	34.29	8.92	9.92	9.42
V_1T_1	100	100	100	100	100	100	80.64	77.90	79.27	40.73	37.60	39.17
V_1T_2	100	100	100	100	100	100	85.14	82.68	83.91	45.94	41.44	43.69
V_1T_3	100	100	100	100	100	100	89.82	87.64	88.73	49.88	46.77	48.33
V_1T_4	100	100	100	100	100	100	96.40	94.66	95.53	56.44	53.62	55.03
V_1T_5	100	100	100	100	100	100	59.08	57.02	58.05	18.00	16.32	17.16
V_1T_6	100	100	100	100	100	100	60.32	57.10	58.71	18.76	16.90	17.83
V_1T_7	100	100	100	100	100	100	100.00	100.00	100.00	70.32	68.20	69.26
V_1T_8	100	100	100	100	100	100	86.78	81.63	84.21	47.84	46.00	46.92
V_1T_9	100	100	100	100	100	100	100.00	100.00	100.00	60.92	58.78	59.85
V_1T_{10}	100	100	100	100	100	100	100.00	100.00	100.00	64.64	63.84	64.24
V_1T_{11}	100	100	100	100	100	100	100.00	100.00	100.00	61.82	59.57	60.69
V_1T_{12}	100	100	100	100	100	100	100.00	100.00	100.00	72.57	70.31	71.44
V_2T_0	100	100	100	100	100	100	37.64	35.02	36.33	9.74	7.82	8.78
V_2T_1	100	100	100	100	100	100	81.86	81.48	81.67	41.97	40.94	41.46
V_2T_2	100	100	100	100	100	100	88.10	87.88	87.99	45.00	41.60	43.30
V_2T_3	100	100	100	100	100	100	90.37	90.12	90.25	50.22	49.81	50.01
V_2T_4	100	100	100	100	100	100	96.94	97.02	96.98	57.04	56.46	56.75
V_2T_5	100	100	100	100	100	100	58.64	58.64	58.64	18.71	17.47	18.09
V_2T_6	100	100	100	100	100	100	59.31	59.42	59.37	19.44	17.58	18.51
V_2T_7	100	100	100	100	100	100	100.00	100.00	100.00	73.28	73.10	73.19
V_2T_8	100	100	100	100	100	100	89.14	88.42	88.78	48.54	45.64	47.09
V_2T_9	100	100	100	100	100	100	100.00	100.00	100.00	58.64	59.14	58.89
V_2T_{10}	100	100	100	100	100	100	100.00	100.00	100.00	69.44	68.31	68.88
V_2T_{11}	100	100	100	100	100	100	100.00	100.00	100.00	63.74	61.39	62.57
V_2T_{12}	100	100	100	100	100	100	100.00	100.00	100.00	73.34	72.27	72.81
S.Em. ±	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.06**	**0.05**	**0.04**	**0.07**	**0.11**	**0.06**
CD (at 5%)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.18**	**0.15**	**0.11**	**0.21**	**0.32**	**0.17**

4.6.2 Marketable fruits (%) at 9th day storage condition

In the both years of experiment i.e. 2015-16 & 2016-17and pooled analysis, revealed that among two variety of guava, Dharidar variety of guava had obtained maximum marketable fruits (48.39, 47.04 and 47.72%) on 9th day at storage condition, respectively. Application of plant growth regulator and nutrients revealed that significant variations were noticed for marketable fruit percentage in two year experiments. In 2015-16, 2016-17 and pooled analysis revealed that maximum marketable fruits (72.96, 71.29 and 72.13%) were obtained in T_{12} which was the statistically superior compare to other treatments followed by T_7 (71.81, 70.65 & 71.23%) and T_{10} (67.04, 66.07 & 66.56%) on 9th day at storage, respectively.

As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar varieties of guava fruits revealed that maximum marketable fruits were procured with V_2T_{12} (73.34%) which was the statistically best over other treatments which was followed by V_2T_7 (73.28%) and V_1T_{12} (72.57%). The minimum marketable fruits (9.47%) were obtained in V_2T_0 in 2015-16. In the following year, maximum marketable fruits were procured with V_2T_7 (73.10%) which was followed by V_2T_{12} (72.27%) and V_1T_{12} (70.31%) and the minimum marketable fruits (7.82%) were obtained in V_2T_0. Pooled analysis revealed that maximum marketable fruits (73.19%) were obtained under V_2T_7 followed by V_2T_{12} (72.81%) and V_1T_{12} (71.44%). However, the minimum marketable fruits (8.78%) were obtained in V_2T_0.

4.7.1 Marketable fruits retained over control (%) at 6th day storage condition

Data presented in Table 4.7 and Fig.4.58 to 4.63 indicated that observation on marketable fruits retained over the control had significantly influenced with pre-harvest application of plant growth regulator and nutrients alone and in combination on 6th day of storage. In the both years of experiment i.e. 2015-16, revealed that among two variety of guava, Dharidar variety of guava had obtained maximum marketable fruits retained over control (48.73%) on 6th day at storage condition. Next year, the Chittidar variety of guava had obtained maximum marketable fruits retained over

control (49.45%) on 6th day at storage condition. Pooled analysis show that maximum marketable fruits retained over control (49.00%) found in Dharidar.

It has been observed that the application of different alone and combined treatments of plant growth regulator and nutrients (GA_3, calcium nitrate and potassium sulphate) proved beneficial effect in obtaining the maximum percentage of marketable fruits retained over the control. Maximum marketable fruits retained over control (63.49%) was procured with T_7, T_9, T_{10}, T_{11} and T_{12} which was followed by T_4 (60.16%) and T_3 (53.58%). Whenever, minimum marketable fruit over retained was obtained was obtained in T_5 treatment (22.34%) in 2015-16. In 206-17 maximum marketable fruits retained over control (65.96%) was procured with T_8 which was followed by T_7, T_9, T_{10}, T_{11} and T_{12} (65.90%) and T_4 (61.74%). Whenever, minimum marketable fruit over retained was obtained was obtained in T_5 treatment (23.73%). Pooled analysis revealed that maximum marketable fruits retained over control (64.69%) were obtained in T_7, T_9, T_{10}, T_{11} and T_{12} treatments which was followed by T_4 (60.95%) and T_3 (54.18%). Minimum marketable fruit over retained (23.04%) was obtained in T_5 treatment on 6th day at storage.

As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar varieties of guava fruits revealed that significant variation was noticed for marketable fruit percentage in two year experiment. Maximum marketable fruits retained over control (64.61%) were obtained in V_1T_7, V_1T_9, V_1T_{10}, V_1T_{11} and V_1T_{12} treatments followed by V_2T_7, V_2T_9, V_2T_{10}, V_2T_{11} and V_2T_{12} treatments (62.36%). However the minimum marketable fruits retained over control (21.00%) was obtained with V_2T_5 on 6th day at storage in year 2015-16. In next year i.e. 2016-17 the Maximum marketable fruits retained over control (66.82%) were obtained in V_1T_7, V_1T_9, V_1T_{10}, V_1T_{11} and V_1T_{12} treatments followed by V_2T_7, V_2T_9, V_2T_{10}, V_2T_{11} and V_2T_{12} treatments (64.98%). However the minimum marketable fruits retained over control (23.62%) with V_2T_5 on 6th day at storage. Pooled analysis revealed that maximum marketable fruits retained over control (65.71%) were obtained in V_1T_7, V_1T_9, V_1T_{10}, V_1T_{11} and V_1T_{12} treatments which was followed by V_2T_7, V_2T_9, V_2T_{10}, V_2T_{11} and V_2T_{12}

treatments (63.67%). However the minimum marketable fruits retained over control (22.31%) with V_2T_5 on 6th day of storage.

4.7.2 Marketable fruits retained over control at 9th day storage condition

Observation on marketable fruit retained over the control had significantly influenced with pre-harvest application of plant growth regulator and nutrients alone and in combination on 9th days of storage. In the both years of experiment i.e. 2015-16 & 2016-17and pooled analysis, revealed that among two variety of guava, Dharidar variety of guava was obtained maximum marketable fruits retained over control (38.65%) & (39.22%) and (38.94%) on 9th day at storage condition, respectively.

It has been observed that the application of different alone and combined treatments of plant growth regulator and nutrients (GA_3, calcium nitrate and potassium sulphate) proved beneficial effect in obtaining the maximum percentage of marketable fruits retained over the control. Maximum marketable fruits retained over control (63.63%) was procured with T_{12} which was followed by T_7 (62.47%) and T_{10} (57.71%). Whenever, minimum marketable fruit over retained over control (9.03%) was obtained was obtained in T_5 treatment on 9th day of storage in 2015-16. In 206-17, maximum marketable fruits retained over control (62.43%) were procured with T_{12} which was followed by $T_{7,}$ (61.78%) and T_{10} (57.21%). Whenever, minimum marketable fruit retained over control (8.03%) was obtained in T_5 treatment on 9th days at storage. On Pooled analysis revealed that maximum marketable fruits retained over control (63.03%) were obtained in T_{12} treatment which was followed by T_7 (62.13) and T_{10} (57.46%). Minimum marketable fruit over control (8.53 %) was obtained in T_5 treatment on 9th day at storage.

As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar varieties of guava fruits revealed that significant variation was noticed for marketable fruit percentage in two year experiment. Maximum marketable fruits retained over control (63.65%) were obtained in V_1T_{12} treatments followed by V_2T_{12} treatments (63.60%) and V_2T_7 (63.54 %). However, the minimum marketable fruits retained over control (8.97%) were obtained with V_2T_5 in year 2015-16.

In next year i.e. 2016-17 the Maximum marketable fruits retained over control (65.28%) were obtained in V_2T_7 treatment followed by V_2T_{12} (64.46%) and V_2T_{10} treatment (60.49%). However the minimum marketable fruits retained over control (6.40%) with V_1T_5 on 9th day at storage. Pooled analysis revealed that maximum marketable fruits retained over control (64.41%) were obtained in V_2T_7 which was followed by V_2T_{12} (64.03%) and V_1T_{12} (62.03 %). However, the minimum marketable fruits retained over control (7.74%) with V_1T_5 on 9th day at storage.

4.8.1 TSS (^{o}Brix) on initial day and 3rd day storage condition

It is clear from Table 4.8 and Fig.4.64 to 4.75 show that in all the treatments, TSS content increased slowly up to 3rd day of storage, thereafter declined slowly under the present two year experiment. In the first years of experiment i.e. 2015-16, revealed that among two variety of guava, Chittidar variety of guava had recorded maximum TSS (10.91 and 12.05^{o}B) on initial day and 3rd day at ambient storage condition respectively. In the following year i.e. 2016-17, Chittidar guava was recorded maximum TSS (11.03 and (12.25^{o}B) on initial day and 3rd day at ambient storage condition respectively. Pooled analysis of data 2015-16 and 2016-17 revealed that variety Chittidar observed maximum TSS (10.97 & 12.15^{o}B). Application of plant growth regulator and nutrients revealed that significant variations were noticed for TSS right from 0 day to 9th days of storage condition. During 2015-16, highest total soluble solids (11.54 and (12.77^{o}B) were found under T_{12} which was followed byT_{10} (11.27 & 12.50^{o}B) and T_8 (11.11 & 12.34^{o}B) on initial day and 3rd day at storage condition, respectively. However, the minimum TSS (9.58 & 10.46^{o}B) was recorded in control treatment on initial day and 3rd day at storage condition, respectively. In the following year i.e. 2016-17 highest TSS (11.68^{o}B and 12.68^{o}B) was recorded in T_{12} and T_{10} on initial day and 3rd day at ambient storage condition respectively. However, the minimum TSS (9.70^o & 10.56^{o}B) was recorded in control treatment on initial day and 3rd day at storage condition, respectively.

Table 4.7: Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on marketable fruits retained over control (%) at 3 day intervals up to 9 days storage

Treatments	Marketable fruits retained over control (%)											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	100	100	100	100	100	100	48.73	49.27	49.00	38.53	35.41	36.97
V_2	100	100	100	100	100	100	47.13	49.45	48.29	38.65	39.22	38.94
S.Em. ±	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.054**	**0.027**	**0.035**	**0.020**	**0.032**	**0.018**
CD (at 5%)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.154**	**0.076**	**0.098**	**0.058**	**0.090**	**0.050**
Plant growth regulator and nutrients												
T_0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T_1	100	100	100	100	100	100	44.73	45.59	45.16	32.02	30.41	31.21
T_2	100	100	100	100	100	100	50.10	51.18	50.64	36.14	32.66	34.40
T_3	100	100	100	100	100	100	53.58	54.78	54.18	40.72	39.42	40.07
T_4	100	100	100	100	100	100	60.16	61.74	60.95	47.41	46.17	46.79
T_5	100	100	100	100	100	100	22.34	23.73	23.04	9.03	8.03	8.53
T_6	100	100	100	100	100	100	23.30	24.16	23.73	9.77	8.37	9.07
T_7	100	100	100	100	100	100	63.49	65.90	64.69	62.47	61.78	62.13
T_8	100	100	100	100	100	100	51.44	50.96	51.20	38.86	36.96	37.91
T_9	100	100	100	100	100	100	63.49	65.90	64.69	50.45	50.09	50.27
T_{10}	100	100	100	100	100	100	63.49	65.90	64.69	57.71	57.21	57.46
T_{11}	100	100	100	100	100	100	63.49	65.90	64.69	53.45	51.61	52.53
T_{12}	100	100	100	100	100	100	63.49	65.90	64.69	63.63	62.43	63.03
S.Em. ±	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.14**	**0.07**	**0.09**	**0.05**	**0.08**	**0.05**
CD (at 5%)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.39**	**0.19**	**0.25**	**0.15**	**0.23**	**0.13**

Interactions												
V_1T_0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V_1T_1	100	100	100	100	100	100	45.24	44.72	44.98	31.81	27.69	29.75
V_1T_2	100	100	100	100	100	100	49.75	49.50	49.63	37.03	31.53	34.28
V_1T_3	100	100	100	100	100	100	54.43	54.46	54.45	40.96	36.85	38.91
V_1T_4	100	100	100	100	100	100	61.01	61.48	61.25	47.53	43.71	45.62
V_1T_5	100	100	100	100	100	100	23.68	23.84	23.76	9.08	6.40	7.74
V_1T_6	100	100	100	100	100	100	24.92	23.92	24.42	9.84	6.99	8.42
V_1T_7	100	100	100	100	100	100	64.61	66.82	65.71	61.41	58.28	59.85
V_1T_8	100	100	100	100	100	100	51.38	48.45	49.92	38.92	36.09	37.51
V_1T_9	100	100	100	100	100	100	64.61	66.82	65.71	52.00	48.86	50.43
V_1T_{10}	100	100	100	100	100	100	64.61	66.82	65.71	55.72	53.92	54.82
V_1T_{11}	100	100	100	100	100	100	64.61	66.82	65.71	52.90	49.65	51.28
V_1T_{12}	100	100	100	100	100	100	64.61	66.82	65.71	63.65	60.40	62.03
V_2T_0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V_2T_1	100	100	100	100	100	100	44.22	46.47	45.34	32.23	33.12	32.68
V_2T_2	100	100	100	100	100	100	50.46	52.86	51.66	35.26	33.78	34.52
V_2T_3	100	100	100	100	100	100	52.74	55.10	53.92	40.47	41.99	41.23
V_2T_4	100	100	100	100	100	100	59.31	62.00	60.65	47.29	48.64	47.97
V_2T_5	100	100	100	100	100	100	21.00	23.62	22.31	8.97	9.65	9.31
V_2T_6	100	100	100	100	100	100	21.67	24.40	23.04	9.70	9.76	9.73
V_2T_7	100	100	100	100	100	100	62.36	64.98	63.67	63.54	65.28	64.41
V_2T_8	100	100	100	100	100	100	51.50	53.47	52.48	38.80	37.83	38.31
V_2T_9	100	100	100	100	100	100	62.36	64.98	63.67	48.90	51.32	50.11
V_2T_{10}	100	100	100	100	100	100	62.36	64.98	63.67	59.70	60.49	60.10
V_2T_{11}	100	100	100	100	100	100	62.36	64.98	63.67	54.00	53.58	53.79
V_2T_{12}	100	100	100	100	100	100	62.36	64.98	63.67	63.60	64.46	64.03
S.Em. ±	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.20**	**0.10**	**0.13**	**0.07**	**0.11**	**0.06**
CD (at 5%)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.55**	**0.27**	**0.35**	**0.21**	**0.32**	**0.18**

Pooled analysis of data 2015-16 and 2016-17 indicated that highest TSS (11.61^{o}B) and (12.59^{o}B) was recorded in T_{12} and T_{10} on initial day and 3rd day at ambient storage condition respectively. The minimum TSS (9.64^{o}B) & (10.51^{o}B) was recorded in T_0 on first day and 3rd day at storage.

As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4)) with Dharidar & Chittidar varieties of guava fruits revealed that maximum TSS (11.76 and 13.02^{o}B) was noted in V_2T_{12} which was followed by V_2T_{10} (11.42 & 12.68^{o}B) and V_2T_8 (11.36 & 12.62^{o}B) on initial day and 3rd day at ambient storage condition, respectively. Whereas, the minimum TSS (9.03 & 10.12^{o}B) was recorded in V_1T_o on first day and 3rd day at storage during 2015-16. In the following year, highest TSS (11.90 & 13.12^{o}B) was recorded in V_2T_{12} which was followed by V_2T_{10} (11.56 & (12.90 ^{o}B) and V_2T_8 (11.51 & 121.74 ^{o}B) on initial day and 3rd day at ambient storage condition, respectively. However, the minimum TSS (9.25 & 10.20^{o}B) was recorded in V_1T_o. Pooled analysis of data 2015-16 and 2016-17 indicated that highest TSS (11.83 and 13.07 ^{o}B) was found in V_2T_{12} followed by V_2T_{10} (11.49 & 12.79^{o}B) V_2T_8 (11.43 and 12.68^{o}B) on initial day and 3rd day at ambient storage condition, respectively. The minimum TSS (9.14 & (10.16^{o}B) was recorded in V_1T_o on initial day and 3rd day at ambient storage condition, r espectively.

4.8.2 TSS (^{o}Brix) on 6th and 9th day storage condition

In the first years of experiment i.e. 2015-16, revealed that among two variety of guava, Chittidar variety of guava had recorded maximum TSS (11.84 and 10.36^{o}B) on 6th and 9th days at ambient storage condition, respectively. In the following year i.e. 2016-17 Chittidar guava recorded maximum TSS (12.01 and 10.40^{o}B) on 6th and 9th days at ambient storage condition, respectively. Pooled analysis of data 2015-16 and 2016-17 revealed that variety Chittidar observed maximum TSS (11.93^{o} & 10.38^{o}B) on 6th and 9th days at ambient storage condition, respectively.

Application of plant growth regulator and nutrients revealed that significant variations were noticed for TSS right from 0 day to 9th days of storage condition. During 2015-16, highest total soluble solids (12.47 and

11.11^{o}B) were found under T_{12} which was followed by T_{10} (12.20 & 11.05^{o}B) and T_8 (12.04 & 10.81^{o}B) on 6th and 9th days at storage condition, respectively. However, the minimum total soluble solids (10.10 & 8.62^{o}B) was recorded in T_0 (control) on 6th and 9th days at storage condition, respectively. In the following year i.e. 2016-17 highest TSS (12.55 and 11.32^{o}B) was recorded in T_{12} followed by T_{10} (12.30 & 11.10 ^{o}B) on 6th and 9th days at ambient storage condition, respectively. However, the minimum total soluble solids (10.69 & 8.67^{o}B) was recorded in T_0 (control) on 6th and 9th days at storage condition, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that highest TSS (12.51 and 11.22^{o}B) was found in T_{12} which was followed by T_{10} (12.25 & 11.08^{o}B) and T_8 (12.08 & 10.84 ^{o}B) on 6th and 9th days at ambient storage condition, respectively. The minimum total soluble solids (10.40 & 8.64^{o}B) were recorded in control treatment on 6th and 9th days at ambient storage condition respectively.

As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar varieties of guava fruits revealed that maximum TSS (12.73 and 11.32^{o}B) was noted in V_2T_{12} which was followed by V_2T_{10} (12.40 & 11.32^{o}B) and V_2T_8 (12.33 & 11.14^{o}B) on 6th and 9th days at ambient storage condition, respectively.

Table 4.8: Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on TSS (^oBrix) at 3 day intervals up to 9 days storage

Treatments	Total Soluble Solids (^oBrix)											
	0 days			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	9.97	10.10	10.04	11.16	11.19	11.18	10.84	10.89	10.87	9.55	9.63	9.59
V_2	10.91	11.03	10.97	12.05	12.25	12.15	11.84	12.01	11.93	10.36	10.40	10.38
S.Em. ±	**0.01**	**0.01**	**0.009**	**0.01**	**0.008**	**0.008**	**0.01**	**0.02**	**0.012**	**0.014**	**0.019**	**0.012**
CD (at 5%)	**0.04**	**0.02**	**0.024**	**0.04**	**0.02**	**0.024**	**0.03**	**0.06**	**0.034**	**0.039**	**0.054**	**0.035**
Plant growth regulator and nutrients												
T_0	9.58	9.70	9.64	10.46	10.56	10.51	10.10	10.69	10.40	8.62	8.67	8.64
T_1	9.96	10.08	10.02	11.14	11.25	11.20	10.81	10.91	10.86	9.55	9.60	9.58
T_2	10.12	10.23	10.18	11.38	11.48	11.43	11.07	11.20	11.14	9.25	9.31	9.28
T_3	9.67	9.79	9.73	10.89	11.01	10.95	10.63	10.71	10.67	9.05	9.11	9.08
T_4	9.73	9.88	9.80	10.96	11.08	11.02	10.66	10.75	10.70	9.28	9.34	9.31
T_5	10.48	10.61	10.54	11.21	11.84	11.52	11.39	11.46	11.43	9.76	9.80	9.78
T_6	10.78	10.91	10.84	12.01	12.11	12.06	11.72	11.64	11.68	10.37	10.42	10.40
T_7	10.21	10.32	10.26	11.43	11.55	11.49	11.14	11.24	11.19	10.03	10.09	10.06
T_8	11.11	11.24	11.18	12.34	12.46	12.40	12.04	12.12	12.08	10.81	10.86	10.84
T_9	10.64	10.78	10.71	11.88	11.99	11.93	11.58	11.66	11.62	10.25	10.30	10.28
T_{10}	11.27	11.40	11.34	12.50	12.68	12.59	12.20	12.30	12.25	11.05	11.10	11.08
T_{11}	10.64	10.76	10.70	11.89	12.01	11.95	11.59	11.67	11.63	10.27	10.31	10.29
T_{12}	11.54	11.68	11.61	12.77	12.38	12.57	12.47	12.55	12.51	11.11	11.32	11.22
S.Em. ±	**0.03**	**0.02**	**0.022**	**0.03**	**0.02**	**0.021**	**0.03**	**0.05**	**0.031**	**0.04**	**0.05**	**0.03**
CD (at 5%)	**0.10**	**0.07**	**0.061**	**0.10**	**0.05**	**0.060**	**0.09**	**0.15**	**0.086**	**0.10**	**0.14**	**0.09**

Interactions												
V_1T_0	9.03	9.25	9.14	10.12	10.20	10.16	9.70	9.78	9.74	8.10	8.16	8.13
V_1T_1	9.29	9.42	9.36	10.40	10.52	10.46	10.00	10.10	10.05	8.90	8.96	8.93
V_1T_2	9.38	9.50	9.44	10.66	10.74	10.70	10.34	10.42	10.38	9.04	9.09	9.06
V_1T_3	9.12	9.24	9.18	10.30	10.42	10.36	10.08	10.15	10.12	8.74	8.80	8.77
V_1T_4	9.14	9.30	9.22	10.33	10.46	10.40	10.02	10.12	10.07	8.80	8.86	8.83
V_1T_5	9.94	10.08	10.01	11.15	11.30	11.23	10.82	10.90	10.86	9.54	9.60	9.57
V_1T_6	10.36	10.49	10.43	11.56	11.64	11.60	11.26	11.01	11.13	10.03	10.08	10.05
V_1T_7	9.52	9.66	9.59	10.72	10.84	10.78	10.42	10.52	10.47	9.16	9.22	9.19
V_1T_8	10.86	10.98	10.92	12.06	12.18	12.12	11.74	11.82	11.78	10.48	10.53	10.50
V_1T_9	10.27	10.40	10.34	11.49	11.60	11.55	11.18	11.26	11.22	9.88	9.93	9.91
V_1T_{10}	11.12	11.24	11.18	12.32	12.46	12.39	12.00	12.08	12.04	10.78	10.84	10.81
V_1T_{11}	10.20	10.32	10.26	11.42	11.52	11.47	11.10	11.18	11.14	9.86	9.90	9.88
V_1T_{12}	11.32	11.46	11.39	12.52	12.64	12.58	12.20	12.30	12.25	10.90	11.25	11.08
V_2T_0	10.12	10.14	10.13	10.80	10.92	10.86	10.50	11.61	11.05	9.14	9.18	9.16
V_2T_1	10.62	10.74	10.68	11.88	11.98	11.93	11.61	11.72	11.67	10.20	10.24	10.22
V_2T_2	10.86	10.96	10.91	12.10	12.22	12.16	11.80	11.98	11.89	9.46	9.52	9.49
V_2T_3	10.22	10.34	10.28	11.47	11.60	11.54	11.18	11.26	11.22	9.36	9.41	9.39
V_2T_4	10.32	10.45	10.39	11.58	11.70	11.64	11.30	11.38	11.34	9.76	9.82	9.79
V_2T_5	11.02	11.14	11.08	11.26	12.38	11.82	11.96	12.03	12.00	9.98	9.99	9.99
V_2T_6	11.20	11.32	11.26	12.46	12.58	12.52	12.18	12.27	12.23	10.72	10.76	10.74
V_2T_7	10.89	10.98	10.93	12.14	12.26	12.20	11.85	11.96	11.91	10.90	10.96	10.93
V_2T_8	11.36	11.51	11.43	12.62	12.74	12.68	12.33	12.42	12.38	11.14	11.19	11.17
V_2T_9	11.00	11.15	11.08	12.26	12.38	12.32	11.98	12.06	12.02	10.62	10.67	10.65
V_2T_{10}	11.42	11.56	11.49	12.68	12.90	12.79	12.40	12.52	12.46	11.32	11.36	11.34
V_2T_{11}	11.08	11.20	11.14	12.36	12.49	12.43	12.08	12.16	12.12	10.68	10.72	10.70
V_2T_{12}	11.76	11.90	11.83	13.02	13.12	13.07	12.73	12.80	12.77	11.32	11.38	11.35
S.Em. ±	**0.05**	**0.03**	**0.03**	**0.05**	**0.02**	**0.03**	**0.04**	**0.07**	**0.04**	**0.05**	**0.07**	**0.04**
CD (at 5%)	**0.14**	**0.10**	**0.08**	**0.15**	**0.08**	**0.08**	**0.13**	**0.21**	**0.12**	**0.14**	**0.19**	**0.12**

Equal performance was observed in V_2T_{12} and V_2T_{10} treatments, however minimum TSS (9.70^{o}B) (8.10^{o}B) was recorded in V_1T_0 during 2015-16. In the following year, highest TSS (12.80 & 11.38^{o}B) was recorded in V_2T_{12} which was followed by V_2T_{10} (12.52 & 11.36 ^{o}B) on 6th and 9th days at ambient storage condition, respectively. Whereas, the minimum TSS (9.78 & 8.16 ^{o}B) was recorded in V_1T_0. Pooled analysis of data 2015-16 and 2016-17 indicated that highest TSS (12.77 and 11.35^{o}B) was found in V_2T_{12} followed by V_2T_{10} (12.46 & 11.34^{o}B) V_2T_8 (12.38 & 11.17^{o}B) on 6th and 9th days at ambient storage condition, respectively. The minimum TSS (9.74 & 8.13^{o}B) was recorded in V_1T_0 on 6th and 9th days at ambient storage condition, respectively.

4.9.1 Acidity (%) on initial day and 3rd day storage condition

The data presented in Table 4.9 and Fig. 4.76 to 4.87 clearly indicated that in all the treatments, acidity increased slowly up to 3rd day of storage, thereafter declined slowly under the present two year experiment. In the first years of experiment i.e. 2015-16, revealed that among two variety of guava, Chittidar variety of guava had recorded minimum acidity (0.45 and 0.51%) on initial day and 3rd day at ambient storage condition, respectively. In the following year i.e. 2016-17 Chittidar guava was recorded minimum acidity (0.46 and 0.52%) on initial day and 3rd day at ambient storage condition, respectively. Pooled analysis of data 2015-16 and 2016-17 revealed that minimum acidity (0.45 and 0.51%) recorded in Chittidar variety on initial day and 3rd day at ambient storage condition respectively. Application of plant growth regulator and nutrients revealed that significant variations were noticed for acidity right from 0 day to 9th days of storage condition. During 2015-16, minimum acidity (0.43%) was observed in T_{12} & T_8 on initial day however at 3rd day of storage the minimum acidity (0.48%) was recorded with T_{12} & $T_{8.}$ However, maximum acidity (0.52 & 0.57%) was recorded in T_3 on initial day and 3rd day at ambient storage condition, respectively. In the following year i.e. 2016-17 minimum acidity (0.44%) was recorded in T_8 which was followed by $T_{12,}$ T_{10} & T_9 on initial at ambient storage condition, respectively. At 3rd day of storage minimum acidity (0.49%) was recorded with T_{12} and T_8. However, the maximum acidity (0.53%) and (0.58%) was recorded in T_3. Pooled

analysis of data 2015-16 and 2016-17 indicated that lowest acidity (0.43%) was found in T_8 followed by in T_{12} & T_{10} on initial day. At 3rd day storage condition the minimum acidity (0.48%) was registered in T_{12} which was followed by T_8 & T_{10}. On initial day the maximum acidity (0.52) was recorded in T_3 while on 3rd day of storage the maximum acidity (0.57%) was recorded in T_3 & T_4, respectively.

Interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) alone and in combination with Dharidar & Chittidar varieties of guava fruits revealed that non-significant variations was found in respect to acidity right from initial days to 9th days of ambient storage condition of guava fruits.

4.9.2 Acidity (%) on 6th and 9th day storage condition

The similar trends in respect to acidity was observed in both year of study however pooled analysis of data 2015-16 and 2016-17 revealed that minimum acidity (0.49%) was recorded in Chittidar variety of guava. There was non-significant observation was recorded in 9th day of storage. Application of plant growth regulator and nutrients revealed that significant variations were noticed for acidity right from 0 day to 9th days of storage condition. During 2015-16, minimum acidity (0.45%) was observed inT_8 followed by T_{12} (0.46%) on 6th days of storage. At 9th day of storage the minimum acidity (0.35%) was recorded inT_{12} followed by T_{10} (0.36) and T_8 (0.37%). However, maximum acidity (0.55%) was recorded in T_3 on 6th days at storage and (0.43%) was recorded in T_0, T_3 & T_4 on 9th day at storage. Next year (2016-17), minimum acidity (0.46%) was observed in T_{12} followed by T_{10} (0.46%) on 6th day of storage. At 9th day of storage the minimum acidity (0.33%) was recorded inT_{12} and T_{10} with which had equal performance followed by T_8 (0.35%) and T_9 (0.36%). Whereas, maximum acidity (0.56%) was recorded in T_3 on 6th days storage and on 9th day storage maximum acidity (0.42%) was recorded in T_1. Pooled analysis of data 2015-16 and 2016-17 indicated that lowest acidity (0.46%) was found in T_8 and $T_{12,}$ with which equal performance on 6th days of storage. At 9th day of storage the minimum acidity (0.34%) was recorded with T_{12} which was followed by T_{10} (0.35%) and T_8 (0.36%). However, on 6th day of storage the maximum acidity

(0.55%) was recorded in T_3 and on 9th day of storage maximum acidity (0.42%) was recorded in T_0, T_1, T_3 & T_4.

4.10 Sugars

4.10.1 Reducing sugars (%) on initial day and 3rd day storage condition

The data presented in Table 10 (a) and Fig. 4.88 to 4.99 show that in all the treatments, reducing sugars increased slowly up to 3rd day of storage, thereafter declined slowly under the present two years experiment. In the first year of experiment i.e. 2015-16, revealed that among two variety of guava, Chittidar variety of guava was recorded maximum reducing sugars (4.12 and 4.47%) on initial day and 3rd day at storage condition, respectively. In the following year i.e. 2016-17, Chittidar variety of guava was recorded maximum reducing sugars (4.35 & 4.71%) on initial day and 3rd day at storage condition, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that Chittidar was registered maximum value in respect to reducing sugars (4.24 and 4.59%) as compare to Dharidar variety of guava (4.21 & 4.54%) on initial day and 3rd day at storage condition, respectively. Application of plant growth regulator and nutrients revealed that treatment T_{12} was registered maximum value as regard to reducing sugars (5.28 & 5.63%) which was statistically superior to other treatments which was followed by T_{10} (4.94 & 5.26%) and T_8 (4.78 & 5.13%) on initial day and 3rd day at storage condition, respectively during 2015-16. In the next year, T_{12} was recorded maximum reducing sugars (5.70%) & (5.89%) which was statistically superior to other treatments which was followed by T_{10} (5.34 & 5.62%) and T_8 (5.18 & 5.48%) on initial day and 3rd day at storage condition respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that treatment T_{12} was recorded maximum reducing sugars (5.49 & 5.76%) which was statistically superior to other treatments which was followed by T_{10} (5.14 & 5.44%) and T_8 (4.98 & 5.30%) on initial day and 3rd at storage condition, respectively.

Table 4.9: Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on acidity (%) at 3 day intervals up to 9 days storage

Treatments	Acidity (%)											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	0.49	0.50	0.49	0.53	0.55	0.54	0.51	0.52	0.51	0.40	0.38	0.39
V_2	0.45	0.46	0.45	0.51	0.52	0.51	0.49	0.49	0.49	0.40	0.38	0.39
S.Em. ±	**0.006**	**0.006**	**0.004**	**0.006**	**0.006**	**0.005**	**0.004**	**0.006**	**0.004**	**0.004**	**0.005**	**0.003**
CD (at 5%)	**0.01**	**0.01**	**0.012**	**0.01**	**0.01**	**0.013**	**0.01**	**0.01**	**0.012**	**NS**	**NS**	**NS**
Plant growth regulator and nutrients												
T_0	0.50	0.51	0.50	0.55	0.56	0.56	0.53	0.54	0.54	0.43	0.41	0.42
T_1	0.50	0.51	0.50	0.54	0.55	0.55	0.52	0.53	0.53	0.43	0.42	0.42
T_2	0.48	0.49	0.49	0.55	0.56	0.55	0.50	0.50	0.50	0.42	0.40	0.41
T_3	0.52	0.53	0.52	0.57	0.58	0.57	0.55	0.56	0.55	0.43	0.41	0.42
T_4	0.51	0.52	0.51	0.56	0.57	0.57	0.54	0.54	0.54	0.43	0.41	0.42
T_5	0.46	0.47	0.47	0.52	0.54	0.53	0.50	0.51	0.50	0.39	0.38	0.38
T_6	0.45	0.46	0.46	0.50	0.51	0.51	0.49	0.50	0.49	0.38	0.37	0.38
T_7	0.48	0.49	0.48	0.53	0.54	0.54	0.50	0.51	0.51	0.41	0.39	0.40
T_8	0.43	0.44	0.43	0.48	0.49	0.49	0.45	0.47	0.46	0.37	0.35	0.36
T_9	0.45	0.45	0.45	0.50	0.52	0.51	0.48	0.49	0.49	0.38	0.36	0.37
T_{10}	0.44	0.45	0.44	0.49	0.50	0.50	0.47	0.48	0.47	0.36	0.33	0.35
T_{11}	0.45	0.46	0.46	0.50	0.51	0.51	0.47	0.48	0.47	0.39	0.37	0.38
T_{12}	0.43	0.45	0.44	0.48	0.49	0.48	0.46	0.46	0.46	0.35	0.33	0.34
S.Em. ±	**0.01**	**0.01**	**0.011**	**0.01**	**0.01**	**0.012**	**0.01**	**0.01**	**0.011**	**0.01**	**0.01**	**0.008**
CD (at 5%)	**0.04**	**0.04**	**0.031**	**0.04**	**0.05**	**0.033**	**0.04**	**0.04**	**0.030**	**0.03**	**0.03**	**0.024**

Interactions												
V_1T_0	0.54	0.55	0.55	0.56	0.57	0.57	0.54	0.55	0.55	0.43	0.42	0.43
V_1T_1	0.52	0.53	0.53	0.55	0.55	0.55	0.52	0.53	0.53	0.41	0.40	0.41
V_1T_2	0.51	0.52	0.52	0.52	0.53	0.53	0.49	0.50	0.50	0.40	0.39	0.40
V_1T_3	0.54	0.54	0.54	0.59	0.60	0.60	0.57	0.58	0.58	0.42	0.39	0.41
V_1T_4	0.53	0.54	0.54	0.58	0.59	0.59	0.56	0.56	0.56	0.42	0.41	0.42
V_1T_5	0.48	0.49	0.49	0.54	0.55	0.55	0.52	0.53	0.52	0.39	0.38	0.39
V_1T_6	0.47	0.48	0.48	0.53	0.54	0.53	0.50	0.51	0.51	0.38	0.37	0.38
V_1T_7	0.49	0.51	0.50	0.55	0.56	0.56	0.51	0.52	0.52	0.40	0.38	0.39
V_1T_8	0.44	0.45	0.45	0.50	0.52	0.51	0.47	0.48	0.48	0.37	0.36	0.36
V_1T_9	0.46	0.47	0.47	0.52	0.54	0.53	0.50	0.51	0.51	0.39	0.37	0.38
V_1T_{10}	0.45	0.46	0.46	0.48	0.49	0.49	0.46	0.47	0.47	0.36	0.34	0.35
V_1T_{11}	0.47	0.48	0.48	0.51	0.53	0.52	0.49	0.50	0.50	0.40	0.39	0.40
V_1T_{12}	0.44	0.45	0.45	0.49	0.51	0.50	0.47	0.47	0.47	0.36	0.34	0.35
V_2T_0	0.46	0.46	0.46	0.54	0.55	0.55	0.52	0.52	0.52	0.42	0.40	0.41
V_2T_1	0.47	0.48	0.48	0.53	0.54	0.54	0.52	0.53	0.53	0.44	0.43	0.44
V_2T_2	0.45	0.46	0.46	0.57	0.58	0.58	0.50	0.50	0.50	0.43	0.41	0.42
V_2T_3	0.49	0.51	0.50	0.55	0.56	0.55	0.53	0.53	0.53	0.44	0.42	0.43
V_2T_4	0.48	0.49	0.49	0.54	0.55	0.55	0.52	0.53	0.53	0.43	0.41	0.42
V_2T_5	0.44	0.45	0.45	0.50	0.52	0.51	0.48	0.49	0.49	0.38	0.37	0.38
V_2T_6	0.43	0.44	0.44	0.47	0.49	0.48	0.48	0.48	0.48	0.38	0.37	0.38
V_2T_7	0.46	0.47	0.47	0.51	0.52	0.52	0.49	0.50	0.50	0.41	0.39	0.40
V_2T_8	0.41	0.42	0.42	0.45	0.46	0.46	0.43	0.45	0.44	0.36	0.34	0.35
V_2T_9	0.43	0.43	0.43	0.48	0.50	0.49	0.46	0.47	0.47	0.37	0.34	0.36
V_2T_{10}	0.42	0.43	0.43	0.49	0.51	0.50	0.47	0.48	0.48	0.35	0.32	0.34
V_2T_{11}	0.43	0.44	0.44	0.48	0.49	0.49	0.45	0.45	0.45	0.37	0.35	0.36
V_2T_{12}	0.42	0.44	0.43	0.46	0.47	0.47	0.44	0.45	0.45	0.34	0.31	0.33
S.Em. ±	**0.02**	**0.02**	**0.01**	**0.02**	**0.02**	**0.01**	**0.02**	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**
CD (at 5%)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

However, the minimum value as regarding to reducing sugars was recorded in control treatment from 0 day to 9th days at storage conditions.

Interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) alone and in combination with Dharidar & Chittidar varieties of guava fruits revealed that maximum reducing sugars (5.29 & 5.66%) was recorded in V_2T_{12} & V_1T_{12} which was followed by V_1T_{12} (5.28%) & V_2T_{12} (5.60%) on initial day and 3rd day at storage condition, respectively. The minimum reducing sugars (2.96 & 3.28%) was recorded in V_1T_0 during the year 2015-16. In next year i.e. 2016-17 revealed that maximum reducing sugars (5.70%) was recorded in V_lT_{12} and V_2T_{12} with which had equal performance followed by V_2T_{10} (5.38%) on initial day of storage. At 3rd day of storage maximum reducing sugars (6.02%) was recorded in V_lT_{12} which was followed by V_2T_{12} (5.76%) and V_2T_{10} (5.68%) respectively. While, the minimum reducing sugars (2.54%) & (3.25%) was recorded in V_1T_0 on first day and 3rd day at storage, respectively. Pooled analysis of data 2015-16 and 2016-17 revealed that maximum reducing sugars (5.49%) was recorded in V_lT_{12} and V_2T_{12} which was followed by V_2T_{10} (5.18%) and V_1T_{10} (5.10%) on initial day of storage, respectively. At 3rd day of storage maximum reducing sugars (5.84%) was recorded in V_lT_{12} which was followed by V_2T_{12} (5.68%) and V_2T_{10} (5.50%), respectively. Whereas, the minimum reducing sugars (2.75 & 3.27%) was recorded in V_1T_0 on initial day and 3rd day of storage, respectively.

4.10.2 Reducing sugars (%) 6th day and 9th day storage condition

Non-significant variations were observed in guava varieties during both years of experiments at 6th days of storage. During the year 2015-16, non significant variations were observed in guava varieties on 9th day of storage. However, maximum reducing sugars (3.96%) was recorded in Dharidar during the year 2016-17. Pooled analysis showed that maximum reducing sugars (3.91%) in Dharidar on 9th day of storage.

Table 4.10 (a): Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on reducing sugars (%) at 3 day intervals up to 9 days storage

Treatments	Reducing sugars (%)											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	4.08	4.34	4.21	4.41	4.68	4.54	4.36	4.52	4.44	3.86	3.96	3.91
V_2	4.12	4.35	4.24	4.47	4.71	4.59	4.32	4.52	4.42	3.75	3.82	3.78
S.Em. ±	**0.007**	**0.007**	**0.005**	**0.01**	**0.01**	**0.008**	**0.01**	**0.01**	**0.011**	**0.004**	**0.008**	**0.005**
CD(at 5%)	**0.02**	**NS**	**0.014**	**0.03**	**NS**	**0.023**	**NS**	**NS**	**NS**	**NS**	**0.02**	**0.013**
Plant growth regulator and nutrients												
T_0	2.97	2.60	2.79	3.31	3.27	3.29	2.99	2.96	2.97	2.74	2.67	2.70
T_1	3.56	3.50	3.53	3.88	3.88	3.88	3.78	3.50	3.64	3.26	3.05	3.15
T_2	3.75	3.65	3.70	4.07	3.91	3.99	3.93	3.68	3.80	3.39	3.12	3.25
T_3	3.25	3.61	3.43	3.59	3.93	3.76	3.45	3.92	3.68	3.02	3.20	3.11
T_4	3.32	3.71	3.51	3.65	4.02	3.83	3.50	3.77	3.64	3.16	3.35	3.25
T_5	3.85	4.25	4.05	4.19	4.56	4.38	4.07	4.36	4.22	3.56	3.74	3.65
T_6	4.10	4.50	4.30	4.44	4.80	4.62	4.31	4.59	4.45	3.82	4.00	3.91
T_7	4.53	4.94	4.74	4.88	5.26	5.07	4.79	5.09	4.94	4.19	4.38	4.29
T_8	4.78	5.18	4.98	5.13	5.48	5.30	5.11	5.40	5.25	4.44	4.63	4.54
T_9	4.34	4.73	4.54	4.70	5.06	4.88	4.57	4.85	4.71	3.96	4.15	4.05
T_{10}	4.94	5.34	5.14	5.26	5.62	5.44	5.29	5.56	5.43	4.66	4.83	4.74
T_{11}	4.66	4.79	4.72	4.98	5.33	5.16	4.95	5.23	5.09	4.29	4.48	4.39
T_{12}	5.28	5.70	5.49	5.63	5.89	5.76	5.64	5.90	5.77	5.00	4.94	4.97
S.Em. ±	**0.01**	**0.01**	**0.012**	**0.03**	**0.03**	**0.021**	**0.04**	**0.03**	**0.027**	**0.01**	**0.02**	**0.012**
CD (at 5%)	**0.05**	**0.05**	**0.034**	**0.09**	**0.08**	**0.060**	**0.13**	**0.09**	**0.076**	**0.03**	**0.06**	**0.032**

Interactions												
V_1T_0	2.96	2.54	2.75	3.28	3.25	3.27	2.96	2.95	2.96	2.88	2.80	2.84
V_1T_1	3.52	3.48	3.50	3.83	3.80	3.82	3.79	3.49	3.64	3.36	3.12	3.24
V_1T_2	3.79	3.72	3.76	4.11	4.02	4.07	4.03	3.69	3.86	3.39	3.14	3.26
V_1T_3	3.22	3.56	3.39	3.56	3.90	3.73	3.46	3.74	3.60	3.28	3.46	3.37
V_1T_4	3.30	3.70	3.50	3.63	4.00	3.82	3.54	3.80	3.67	3.33	3.52	3.43
V_1T_5	3.92	4.31	4.11	4.24	4.62	4.43	4.16	4.46	4.31	3.60	3.78	3.69
V_1T_6	4.02	4.40	4.21	4.35	4.72	4.53	4.28	4.56	4.42	3.92	4.09	4.00
V_1T_7	4.51	4.92	4.71	4.84	5.20	5.02	4.80	5.09	4.95	4.12	4.30	4.21
V_1T_8	4.73	5.12	4.93	5.07	5.42	5.25	5.13	5.43	5.28	4.44	4.63	4.53
V_1T_9	4.38	4.78	4.58	4.71	5.06	4.89	4.68	4.96	4.82	3.99	4.17	4.08
V_1T_{10}	4.90	5.30	5.10	5.20	5.56	5.38	5.28	5.56	5.42	4.66	4.84	4.75
V_1T_{11}	4.54	4.92	4.73	4.86	5.22	5.04	4.86	5.13	5.00	4.17	4.36	4.27
V_1T_{12}	5.28	5.70	5.49	5.66	6.02	5.84	5.67	5.94	5.81	5.06	5.26	5.16
V_2T_0	2.98	2.66	2.82	3.34	3.28	3.31	3.02	2.96	2.99	2.60	2.53	2.57
V_2T_1	3.60	3.52	3.56	3.94	3.95	3.95	3.76	3.51	3.64	3.15	2.98	3.07
V_2T_2	3.72	3.58	3.65	4.02	3.80	3.91	3.82	3.66	3.74	3.39	3.09	3.24
V_2T_3	3.28	3.67	3.47	3.62	3.96	3.79	3.43	4.09	3.76	2.76	2.94	2.85
V_2T_4	3.33	3.72	3.53	3.67	4.03	3.85	3.46	3.74	3.60	2.98	3.17	3.08
V_2T_5	3.79	4.20	3.99	4.15	4.50	4.32	3.98	4.26	4.12	3.52	3.70	3.61
V_2T_6	4.18	4.60	4.39	4.54	4.89	4.71	4.34	4.62	4.48	3.72	3.91	3.82
V_2T_7	4.55	4.97	4.76	4.92	5.32	5.12	4.78	5.08	4.93	4.26	4.46	4.36
V_2T_8	4.83	5.24	5.04	5.18	5.54	5.36	5.09	5.36	5.23	4.44	4.63	4.54
V_2T_9	4.30	4.68	4.49	4.68	5.06	4.87	4.46	4.73	4.60	3.93	4.13	4.03
V_2T_{10}	4.97	5.38	5.18	5.32	5.68	5.50	5.30	5.56	5.43	4.65	4.83	4.74
V_2T_{11}	4.77	4.65	4.71	5.10	5.45	5.28	5.05	5.33	5.19	4.41	4.60	4.50
V_2T_{12}	5.29	5.70	5.49	5.60	5.76	5.68	5.60	5.86	5.73	4.94	4.63	4.79
S.Em. ±	**0.02**	**0.02**	**0.01**	**0.04**	**0.04**	**0.03**	**0.06**	**0.04**	**0.03**	**0.01**	**0.03**	**0.01**
CD (at 5%)	**0.07**	**0.07**	**0.04**	**0.12**	**0.12**	**0.08**	**NS**	**0.13**	**0.10**	**0.04**	**0.08**	**0.04**

Table 4.10 (b): Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on non reducing sugars (%) at 3 days intervals up to 9 days storage

Treatments	Non-reducing sugars (%)											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	3.52	3.38	3.50	4.23	4.15	4.19	3.74	3.69	3.71	3.40	3.27	3.34
V_2	3.62	3.54	3.58	4.40	4.30	4.35	4.02	3.85	3.93	3.54	3.36	3.45
S.Em. ±	**0.004**	**0.007**	**0.004**	**0.004**	**0.014**	**0.007**	**0.002**	**0.02**	**0.013**	**0.008**	**0.008**	**0.005**
CD(at 5%)	**0.01**	**0.02**	**0.012**	**0.010**	**0.039**	**0.020**	**0.07**	**0.07**	**0.037**	**0.02**	**0.02**	**0.015**
Plant growth regulator and nutrients												
T_0	2.70	2.77	2.74	3.41	3.51	3.46	2.87	2.96	2.91	2.31	2.38	2.35
T_1	3.00	2.80	2.90	3.64	3.48	3.56	3.36	3.20	3.28	3.08	2.92	3.00
T_2	3.14	2.94	3.04	3.82	3.67	3.74	3.48	3.32	3.40	2.93	2.74	2.83
T_3	2.70	2.70	2.70	3.06	3.20	3.13	2.81	2.78	2.79	2.33	2.25	2.29
T_4	2.83	2.86	2.84	3.43	3.48	3.46	3.13	3.11	3.12	2.69	2.47	2.58
T_5	3.47	3.54	3.51	4.25	4.31	4.28	3.79	3.76	3.77	3.37	3.19	3.28
T_6	3.55	3.62	3.59	4.43	4.31	4.37	3.90	3.84	3.87	3.56	3.37	3.47
T_7	3.86	3.78	3.82	4.68	4.57	4.62	4.16	3.98	4.07	3.83	3.58	3.70
T_8	4.14	4.00	4.07	5.20	4.72	4.96	4.72	4.55	4.63	4.13	3.96	4.04
T_9	3.73	3.63	3.68	4.38	4.31	4.35	3.87	3.72	3.79	3.75	3.59	3.67
T_{10}	4.55	4.44	4.50	5.41	5.33	5.37	4.91	4.76	4.83	4.46	4.37	4.42
T_{11}	4.04	3.91	3.97	4.93	4.81	4.87	4.45	4.29	4.37	4.00	3.79	3.90
T_{12}	4.71	4.61	4.66	5.43	5.27	5.35	4.94	4.75	4.84	4.66	4.53	4.60
S.Em. ±	**0.01**	**0.01**	**0.011**	**0.01**	**0.04**	**0.02**	**0.006**	**0.06**	**0.034**	**0.02**	**0.02**	**0.014**
CD (at 5%)	**0.03**	**0.05**	**0.031**	**0.03**	**0.10**	**0.05**	**0.18**	**0.19**	**0.094**	**0.05**	**0.06**	**0.039**

Interactions												
V_1T_0	2.70	2.82	2.76	3.48	3.58	3.53	2.90	3.00	2.95	2.22	2.31	2.26
V_1T_1	2.97	2.76	2.87	3.71	3.56	3.63	3.30	3.16	3.23	2.96	2.83	2.90
V_1T_2	3.09	2.89	2.99	3.77	3.62	3.70	3.28	3.14	3.21	3.21	3.01	3.11
V_1T_3	2.69	2.70	2.69	3.11	3.23	3.17	2.69	2.75	2.72	2.10	2.18	2.14
V_1T_4	2.79	2.83	2.81	3.53	3.60	3.57	3.02	3.12	3.07	2.55	2.41	2.48
V_1T_5	3.47	3.52	3.50	4.16	4.21	4.19	3.70	3.82	3.76	3.41	3.26	3.33
V_1T_6	3.60	3.65	3.62	4.43	4.30	4.37	3.94	4.06	4.00	3.58	3.36	3.47
V_1T_7	3.75	3.70	3.72	4.38	4.30	4.34	3.86	3.69	3.78	3.80	3.56	3.68
V_1T_8	4.03	3.98	4.00	4.99	4.87	4.93	4.52	4.39	4.46	4.00	3.82	3.91
V_1T_9	3.64	3.56	3.60	4.08	3.92	4.00	3.56	3.43	3.49	3.69	3.52	3.60
V_1T_{10}	4.50	4.42	4.46	5.24	5.06	5.15	4.72	4.59	4.66	4.36	4.33	4.34
V_1T_{11}	3.88	3.75	3.82	4.75	4.61	4.68	4.30	4.16	4.23	3.82	3.58	3.70
V_1T_{12}	4.63	4.60	4.62	5.30	5.11	5.21	4.76	4.60	4.68	4.50	4.39	4.44
V_2T_0	2.71	2.72	2.71	3.34	3.43	3.39	2.84	2.92	2.88	2.40	2.45	2.43
V_2T_1	3.04	2.84	2.94	3.57	3.40	3.49	3.41	3.23	3.32	3.20	3.00	3.10
V_2T_2	3.18	2.98	3.08	3.86	3.72	3.79	3.67	3.49	3.58	2.65	2.46	2.55
V_2T_3	2.72	2.70	2.71	3.02	3.16	3.09	2.93	2.80	2.87	2.56	2.32	2.44
V_2T_4	2.87	2.89	2.88	3.33	3.36	3.35	3.24	3.09	3.17	2.82	2.53	2.68
V_2T_5	3.47	3.56	3.51	4.33	4.41	4.37	3.88	3.69	3.79	3.33	3.12	3.22
V_2T_6	3.50	3.59	3.55	4.42	4.32	4.37	3.85	3.62	3.74	3.54	3.38	3.46
V_2T_7	3.97	3.85	3.91	4.97	4.83	4.90	4.45	4.26	4.36	3.86	3.59	3.73
V_2T_8	4.25	4.03	4.14	5.40	4.57	4.99	4.91	4.71	4.81	4.26	4.10	4.18
V_2T_9	3.82	3.69	3.75	4.68	4.70	4.69	4.19	4.00	4.09	3.80	3.66	3.73
V_2T_{10}	4.61	4.46	4.53	5.58	5.60	5.59	5.11	4.92	5.01	4.57	4.41	4.49
V_2T_{11}	4.19	4.06	4.12	5.12	5.00	5.06	4.60	4.42	4.51	4.17	4.01	4.09
V_2T_{12}	4.79	4.62	4.70	5.56	5.43	5.50	5.12	4.90	5.01	4.82	4.68	4.75
S.Em. ±	**0.01**	**0.02**	**0.01**	**0.01**	**0.05**	**0.03**	**0.06**	**0.09**	**0.04**	**0.02**	**0.03**	**0.01**
CD (at 5%)	**0.04**	**0.07**	**0.04**	**0.04**	**0.14**	**0.07**	**0.19**	**0.27**	**0.12**	**0.08**	**0.08**	**0.05**

Application of plant growth regulator and nutrients revealed that treatment T_{12} was registered maximum value as regard to reducing sugars (5.64 & 5.00%) which was statistically superior to other treatments which was followed by T_{10} (5.29 & 4.66%) and T_8 (5.11 & 4.44 %) on 6th and 9th days at storage condition, respectively during 2015-16. In the next year, T_{12} was recorded maximum reducing sugars (5.90 & 4.94%) which was statistically superior to other treatments which was followed by T_{10} (5.56 & 4.83%) and T_8 (5.40 & 4.63%) on 6th and 9th days at storage condition, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that treatment T_{12} was recorded maximum reducing sugars (5.77 & 4.97%) which was statistically superior to other treatments which was followed by T_{10} (5.43 & 4.74%) and T_8 (5.25 & 4.54%) on 6th and 9th days at storage condition, respectively. The minimum values with relation to reducing sugars were registered in control treatment from initial day to 9th days at storage condition.

In interaction study non-significant variations was observed during 2015-2016 on 6th day of storage however reducing content ranged from maximum (5.06%) was recorded with V_1T_{12} followed by V_2T_{12} (4.94%) on 9th day storage. During year 2016-17, maximum reducing sugars (5.94 & 5.26%) was recorded in V_1T_{12} which was followed by V_1T_{12} (5.86%) & V_2T_{10} (4.83%) on 6th and 9th days of storage condition respectively. Pooled analysis of data 2015-16 and 2016-17 revealed that maximum reducing sugars (5.81%) was recorded in V_IT_{12} which was followed by V_2T_{12} (5.73%) and V_2T_{10} (5.43%) on 6th day of storage, respectively. However, the minimum reducing sugars (2.96%) was recorded in V_IT_0. At 9th day of storage maximum reducing sugars (5.16%) was recorded in V_IT_{12} which was followed by V_2T_{12} (4.79%) and V_1T_{10} (4.75%), respectively. The minimum reducing sugars (2.57%) was recorded in V_2T_0.

4.11.1 Non-reducing sugars (%) on initial day and 3rd day storage condition

The data depicted in Table 4.10 (b) and Fig. 4.100 to 4.111 indicated that in all the treatments, non-reducing sugars increased slowly up to 3rd day of storage, thereafter declined slowly under the present two years experiment. In the first years of experiment i.e. 2015-16, revealed that among two variety

of guava, Chittidar variety of guava was recorded maximum non-reducing sugars (3.62 and 4.40%) on initial day and 3rd day at storage condition, respectively. In the following year i.e. 2016-17, Chittidar variety of guava was recorded maximum non-reducing sugars (3.54 & 4.30%) on initial day and 3rd day at storage condition, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that Chittidar was registered maximum value in respect to non-reducing sugars (3.58 and 4.35%) as compare to Dharidar variety of guava on initial day and 3rd day at storage condition, respectively.

Application of plant growth regulator and nutrients revealed that treatment T_{12} was registered maximum value as regard to non-reducing sugars (4.71 & 5.43%) which was statistically superior to other treatments which was followed by T_{10} (4.55 & 5.41%) and T_8 (4.14 & 5.20%) on initial day and 3rd day at storage condition, respectively. The minimum non-reducing sugars (2.70%) were recorded in T_0 and T_3 on initial day and on 3rd day minimum non-reducing sugars (3.06%) was recorded in T_3 on initial day and 3rd day at storage condition, respectively during 2015-16. In the next year, T_{12} was recorded maximum non-reducing sugars (4.61 & 5.27%) which was statistically superior to other treatments which was followed by T_{10} (4.44 & 5.33%) on initial day and 3rd day at storage condition, respectively. However, the minimum non-reducing sugars (2.70 & 3.20%) were recorded in T_3 on initial day and 3rd day at storage condition, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that treatment T_{12} was recorded maximum non-reducing sugars (4.66%) which was statistically superior to other treatments which was followed by T_{10} (4.50%) and T_8 (4.07%) on initial day at storage condition, respectively. However, at 3rd day of storage maximum non-reducing sugars (5.37%) was recorded in T_{10} which was followed by T_{12} (5.35%) and T_8 (4.96%) respectively. While, the minimum non-reducing sugars (2.70%) % (3.13%) was recorded in T_3 on initial day and 3rd day at storage condition, respectively.

Interaction study of gibberellic acid (GA_3), calcium nitrate {Ca $(NO_3)_2$} & potassium sulphate (K_2SO_4) alone and in combination with Dharidar & Chittidar varieties of guava fruits revealed that maximum non-reducing sugars (4.79%) & (5.58%) was recorded in V_2T_{12} & V_2T_{10} which was followed by

V_2T_{12} (5.56%) & V_1T_{12} (5.30%) on initial day and 3rd day at storage condition respectively, the minimum non-reducing sugars (2.69%) was recorded in V_1T_3 on initial day and on 3rd day storage the minimum non-reducing sugars (3.02%) was recorded in V_2T_3 during the year 2015-16. In next year i.e. 2016-17 revealed that maximum non-reducing sugars (4.62%) was recorded in V_2T_{12} followed by V_1T_{12} (4.60%) on initial day of storage. At 3rd day of storage maximum non-reducing sugars (5.60%) were recorded in V_2T_{10} which was followed by V_2T_{12} (5.43%) and V_1T_{12} (5.11%), respectively. The minimum non-reducing sugars (2.70 & 3.16%) were recorded in V_2T_3 on first day and on 3rd day storage, respectively.

Pooled analysis of data 2015-16 and 2016-17 revealed that maximum non-reducing sugars (4.70%) was recorded in V_2T_{12} which was followed by V_1T_{12} (4.62%) and V_2T_{10} (4.53%) on initial day of storage, respectively. At 3rd day of storage maximum non-reducing sugars (5.59%) was recorded in V_2T_{10} which was followed by V_2T_{12} (5.50%) and V_2T_{12} (5.21%), respectively. However, minimum non-reducing sugars (2.69%) were recorded in V_1T_3 on first day and on 3rd day storage the minimum non-reducing sugars (3.09%) was recorded in V_2T_3.

4.11.2 Non-reducing sugars (%) 6th day and 9th day storage condition

In the first years of experiment i.e. 2015-16, revealed that among two variety of guava, Chittidar variety of guava was recorded maximum non-reducing sugars (4.02 and 3.54%) on 6th and 9th days at storage condition, respectively. In the following year i.e. 2016-17, Chittidar variety of guava was recorded maximum non-reducing sugars (3.85 & 3.36%) on 6th and 9th days at storage condition, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that Chittidar was registered maximum value in respect to non-reducing sugars (3.93 and 3.45%) as compare to Dharidar variety of guava on 6th and 9th days at storage condition, respectively.

Application of plant growth regulator and nutrients revealed that treatment T_{12} was registered maximum value as regard to non-reducing sugars (4.94 & 4.66%) which was followed by T_{10} (4.91 & 4.46%) and T_8 (4.72 & 4.13%) 6th and 9th days at storage condition, respectively, the minimum non

reducing sugars (2.81%) was recorded in T_3 on 6th day and on 9th day storage the minimum non-reducing sugars (2.31%) was recorded in T_0 during 2015-16. In the following year i.e. 2016-17, T_{10} was recorded maximum non-reducing sugars (4.76%) which followed by T_{12} (4.75%) & T_8 (4.55%) 6th at storage condition respectively. Whereas, on 9th day storage the maximum non- reducing sugars (4.53%) were recorded in T_{12} which was followed by T_{10} (4.37%) and T_8 (3.96%). Pooled analysis of data 2015-16 and 2016-17 indicated that treatment T_{12} was recorded maximum non-reducing sugars (4.84 and 4.60%) which was followed by T_{10} (4.83 & 4.42%) and T_8 (4.63 & 4.04%) on 6th and 9th days at storage condition, respectively. However, the minimum non-reducing sugars (2.79%) & (2.29%) was recorded in T_3 on 6th and 9th days at storage, respectively.

Interaction study of gibberellic acid (GA_3), calcium nitrate $Ca(NO_3)_2$ & potassium sulphate (K_2SO_4) alone and in combination with Dharidar & Chittidar varieties of guava fruits revealed that maximum non-reducing sugars (5.12 & 4.82%) was recorded in V_2T_{12} which was followed by V_2T_{10} (5.11%) & V_2T_{10} (4.57%) on 6th and 9th days at storage condition respectively, minimum non-reducing sugars (2.69%) & (2.10%) was recorded in V_1T_3 during 2015-2016. In next year maximum non-reducing sugars (4.92%) was recorded in V_2T_{10} followed by V_2T_{12} (4.90%) & V_2T_8 (4.71%) on 6th day storage, respectively. At 9th day of storage the maximum non-reducing sugars (4.68%) was recorded in V_2T_{12} followed by V_2T_{10} (4.41%) and V_1T_{12} (4.39%) respectively, minimum non-reducing sugars (2.75%) & (2.18%) was recorded in V_1T_3 on 6th and 9th days at storage, respectively.

Pooled analysis of data 2015-16 and 2016-17 revealed that maximum non-reducing sugars (5.01%) was recorded in V_2T_{12} & V_2T_{10} which was had equal performance followed by V_2T_8 (4.81%) and V_1T_{12} (4.68%) on 6th day storage, respectively. At 9th day of storage the maximum non-reducing sugars (4.75%) was recorded with V_2T_{12} which was followed by V_2T_{10} (4.49%) and V_1T_{12} (4.44%), respectively. However, the minimum non-reducing sugars (2.72%) & (2.14%) was recorded in V_1T_3 on 6th and 9th days at storage, respectively.

4.12.1 Total sugars (%) on initial day and 3rd day storage condition

The data presented in Table 4.10 (c) and Fig. 4.112 to 4.123 showed that in all the treatments, total sugars increased slowly up to 3rd day of storage, thereafter declined slowly under the present two years experiment. In the first years of experiment i.e. 2015-16, revealed that among two variety of guava, Chittidar variety of guava was recorded maximum total sugars (7.75 and 8.87%) on initial day and 3rd day at storage condition, respectively. In the next year i.e. 2016-17, Chittidar variety of guava was recorded maximum total sugars (7.89 & 9.01%) on initial day and 3rd day at storage condition, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that Chittidar was registered maximum value in respect to total sugars (7.82 and 8.94%) as compare to Dharidar variety of guava on initial day and 3rd day at storage condition, respectively.

Application of plant growth regulator and nutrients revealed that maximum total sugars (10.00 and 11.06%) was recorded with treatment T_{12} which was followed by T_{10} (9.50 & 10.67%) and T_8 (8.92 & 10.32%) on initial day and 3rd day at storage condition, respectively, the minimum total sugars (5.67 & 6.72%) was recorded under control treatment on initial day and 3rd at storage condition respectively in the year 2015-16. In the next year, the maximum total sugars was recorded in T_{12} (10.31 & 11.16%) followed by T_{10} (9.78 & 10.95%) and T_8 (9.19 & 10.20%). However, minimum total sugars (5.37 & 6.77%) were recorded in T_0 on initial day and 3rd day at storage. Pooled analysis of data 2015-16 and 2016-17 revealed that maximum total sugars (10.15 & 11.11%) was recorded in T_{12} which was followed by T_{10} (9.64 & 10.81%) and T_8 (9.06 & 10.26%) on initial day and 3rd day at storage conditions, respectively. Whereas, minimum total sugars (5.52 & 6.74%) was recorded in T_0 on initial day and 3rd day at storage conditions, respectively.

Table 4.10 (c): Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on total sugars (%) at 3 day intervals up to 9 days storage

Treatments	Total sugars (%)											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	7.60	7.83	7.71	8.64	8.90	8.77	8.26	8.21	8.23	7.26	7.23	7.25
V_2	7.75	7.89	7.82	8.87	9.01	8.94	8.61	8.37	8.49	7.24	7.18	7.21
S.Em. ±	**0.008**	**0.009**	**0.006**	**0.008**	**0.01**	**0.007**	**0.002**	**0.007**	**0.006**	**0.009**	**0.007**	**0.006**
CD (at 5%)	**0.02**	**0.02**	**0.017**	**0.02**	**0.03**	**0.020**	**0.07**	**0.02**	**0.017**	**0.02**	**0.02**	**0.016**
Plant growth regulator and nutrients												
T_0	5.67	5.37	5.52	6.72	6.77	6.74	6.30	5.91	6.10	5.05	5.04	5.05
T_1	6.57	6.30	6.43	7.53	7.36	7.44	7.35	6.70	7.02	6.27	5.96	6.12
T_2	6.89	6.59	6.74	7.88	7.59	7.73	7.66	6.99	7.32	6.07	5.85	5.96
T_3	5.95	6.32	6.13	6.66	7.12	6.89	6.52	6.69	6.60	5.35	5.45	5.40
T_4	6.15	6.57	6.36	7.08	7.49	7.29	6.90	6.88	6.89	5.84	5.81	5.83
T_5	7.33	7.84	7.59	8.44	8.87	8.66	8.11	8.12	8.11	6.93	6.93	6.93
T_6	7.65	8.12	7.89	8.87	9.12	8.99	8.47	8.43	8.45	7.38	7.37	7.38
T_7	8.39	8.72	8.56	9.55	9.83	9.69	9.16	9.06	9.11	8.02	7.96	7.99
T_8	8.92	9.19	9.06	10.32	10.20	10.26	9.97	9.94	9.96	8.57	8.59	8.58
T_9	8.07	8.36	8.21	9.08	9.82	9.45	8.68	8.56	8.62	7.70	7.74	7.72
T_{10}	9.50	9.78	9.64	10.67	10.95	10.81	10.31	10.32	10.31	9.12	9.20	9.16
T_{11}	8.69	8.69	8.69	9.92	10.14	10.03	9.55	9.52	9.54	8.29	8.28	8.28
T_{12}	10.00	10.31	10.15	11.06	11.16	11.11	10.70	10.65	10.68	9.66	9.48	9.57
S.Em. ±	**0.02**	**0.02**	**0.015**	**0.02**	**0.03**	**0.018**	**0.006**	**0.01**	**0.016**	**0.02**	**0.01**	**0.014**
CD (at 5%)	**0.06**	**0.07**	**0.043**	**0.06**	**0.09**	**0.051**	**0.18**	**0.05**	**0.044**	**0.05**	**0.05**	**0.040**

Interactions												
V_1T_0	5.66	5.36	5.51	6.76	6.83	6.79	6.29	5.95	6.12	5.10	5.10	5.10
V_1T_1	6.49	6.24	6.37	7.54	7.36	7.45	7.22	6.65	6.93	6.32	5.95	6.13
V_1T_2	6.88	6.61	6.75	7.88	7.65	7.77	7.49	6.83	7.16	6.60	6.15	6.38
V_1T_3	5.91	6.26	6.08	6.67	7.13	6.90	6.36	6.49	6.42	5.38	5.64	5.51
V_1T_4	6.09	6.53	6.31	7.16	7.60	7.38	6.77	6.92	6.85	5.88	5.93	5.90
V_1T_5	7.39	7.93	7.66	8.40	8.83	8.61	8.06	8.28	8.17	7.01	7.04	7.02
V_1T_6	7.62	8.05	7.84	8.78	9.02	8.90	8.42	8.62	8.52	7.50	7.45	7.48
V_1T_7	8.26	8.62	8.44	9.22	9.50	9.36	8.82	8.78	8.80	7.92	7.86	7.89
V_1T_8	8.76	9.10	8.93	10.06	10.29	10.17	9.73	9.82	9.78	8.44	8.45	8.45
V_1T_9	8.02	8.34	8.18	8.79	9.88	9.34	8.38	8.39	8.39	7.68	7.69	7.68
V_1T_{10}	9.41	9.72	9.57	10.44	10.62	10.53	10.05	10.15	10.10	9.02	9.17	9.09
V_1T_{11}	8.42	8.67	8.55	9.61	9.83	9.72	9.26	9.29	9.28	7.99	7.94	7.97
V_1T_{12}	9.91	10.30	10.10	10.96	11.13	11.04	10.54	10.54	10.54	9.56	9.65	9.61
V_2T_0	5.69	5.38	5.53	6.68	6.71	6.69	6.30	5.88	6.09	5.00	4.98	4.99
V_2T_1	6.64	6.36	6.50	7.51	7.35	7.43	7.47	6.74	7.11	6.22	5.98	6.10
V_2T_2	6.90	6.56	6.73	7.88	7.52	7.70	7.82	7.15	7.49	5.54	5.55	5.55
V_2T_3	6.00	6.37	6.19	6.64	7.12	6.88	6.68	6.89	6.78	5.32	5.26	5.29
V_2T_4	6.20	6.61	6.40	7.00	7.39	7.19	7.02	6.83	6.93	5.80	5.70	5.75
V_2T_5	7.26	7.76	7.51	8.48	8.91	8.70	8.15	7.95	8.05	6.85	6.82	6.83
V_2T_6	7.68	8.19	7.94	8.96	9.21	9.09	8.52	8.24	8.38	7.26	7.29	7.28
V_2T_7	8.52	8.82	8.67	9.89	10.15	10.02	9.50	9.34	9.42	8.12	8.05	8.09
V_2T_8	9.08	9.27	9.18	10.58	10.11	10.35	10.21	10.07	10.14	8.70	8.73	8.72
V_2T_9	8.12	8.37	8.25	9.36	9.76	9.56	8.98	8.73	8.86	7.73	7.78	7.76
V_2T_{10}	9.58	9.84	9.71	10.90	11.28	11.09	10.56	10.48	10.52	9.22	9.24	9.23
V_2T_{11}	8.96	8.71	8.84	10.23	10.45	10.34	9.84	9.75	9.79	8.58	8.61	8.59
V_2T_{12}	10.08	10.32	10.20	11.16	11.19	11.18	10.86	10.76	10.81	9.76	9.31	9.54
S.Em. ±	**0.03**	**0.03**	**0.02**	**0.03**	**0.04**	**0.02**	**0.06**	**0.02**	**0.02**	**0.03**	**0.02**	**0.02**
CD (at 5%)	**0.08**	**0.10**	**0.06**	**0.09**	**0.13**	**0.07**	**0.19**	**0.08**	**0.06**	**0.09**	**0.07**	**0.05**

Interaction study revealed that maximum total sugars was recorded in V_2T_{12} (10.08 & 11.16%) followed by V_1T_{12} (9.91 & 10.96%) and V_2T_{10} (9.58 & 10.90%) on initial day and 3rd day at storage condition, respectively in the year 2015-16. In next year i.e. 2016-17 interaction study revealed that maximum total sugars was recorded in V_2T_{12} (10.32 & 11.19%) followed by V_1T_{12} (10.30 & 11.13%) and V_2T_{10} (9.84 & 11.28%) on initial day and 3rd day at storage condition, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that the maximum total sugars (10.20%) & (11.18%) was recorded in V_2T_{12} which was followed by V_1T_{12} (10.10%) on first day of storage and V_2T_{10} (11.09%) on 3rd day of storage condition, respectively.

4.12.2 Total sugars (%) 6th and 9th day storage condition

In the first years of experiment i.e. 2015-16, revealed that among two variety of guava, Chittidar variety of guava was recorded maximum total sugars (8.61%) on 6th day however on 9th day at storage condition the maximum total sugars (7.24%) was recorded with Dharidar, respectively. In the following year i.e. 2016-17, Chittidar variety of guava was recorded maximum total sugars (8.37%) on 6th day of storage condition. At 9th day at storage condition the maximum total sugars (7.23%) was recorded with Dharidar. Pooled analysis of data 2015-16 and 2016-17 revealed that maximum total sugars (8.49%) was recorded in Chittidar on 6th day of storage, however at 9th day of storage the maximum total sugars (7.25%) was recorded with Dharidar. Application of plant growth regulator and nutrients revealed that treatment T_{12} was recorded maximum total sugars (10.70 and 9.66%) which was followed by T_{10} (10.31 & 9.12%) and T_8 (9.97 & 8.57%) on 6th and 9th days storage condition, respectively in the year 2015-16. In the next year, the maximum total sugars (10.65 & 9.48%) was recorded in T_{12} followed by T_{10} (10.32 & 9.20%) and T_8 (9.94 & 8.59%) on 6th and 9th days storage, respectively. Pooled analysis of data 2015-16 and 2016-17 revealed that maximum total sugars (10.68 & 9.57%) was recorded in T_{12} which was followed by T_{10} (10.31 & 9.16%) and T_8 (9.96 & 8.58%) on 6th and 9th days storage condition, respectively.

Interaction study revealed that maximum total sugars (10.86%) was recorded in V_2T_{12} followed by V_2T_{10} (10.56%) and V_1T_{12} (10.54%) on 6th day. At 9th day storage conditions maximum total sugars (9.76%) was recorded in V_2T_{12} followed by V_1T_{12} (9.56%) and V_2T_{10} (9.22%), respectively in the year 2015-16. In next year i.e. 2016-17 interaction study revealed that maximum total sugars (10.76) was recorded in V_2T_{12} followed by V_1T_{12} (10.54%) and V_2T_{10} (10.48) on 6th day storage conditions. However, at 9th day of storage the maximum total sugars (9.65%) was recorded in V_1T_{12} which was followed by V_2T_{12} (9.31%) and V_2T_{10} (9.23%), respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that the maximum total sugars (10.81%) was recorded in V_2T_{12} which was followed by V_1T_{12} (10.54%) and V_2T_{10} (10.52%) on 6th day of storage, respectively. While on 9th day storage conditions the maximum total sugars (9.65%) was recorded in V_1T_{12} followed by V_2T_{12} (9.31%) and V_2T_{10} (9.23%) on 6th and 9th days at storage, respectively.

4.13.1 Pectin (%) on initial day and 3rd day storage condition

Data depicted in Table 4.11 and Fig 4.124 to 4.135 showed that the maximum pectin content (0.91 & (.84%) was noted with Dharidar on initial day and 3rd day at storage condition, respectively in the experiment year of 2015-16. In the following year, 2016-17 maximum pectin content (0.93 & 0.85%) was noted with Dharidar on first and 3rd day of storage, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that Dharidar was registered maximum value in respect to pectin content (0.92 and 0.84%) as compare to Chittidar variety of guava on initial day and 3rd day at storage condition, respectively. In year 2015-16 application of plant growth regulator and nutrients showed that the maximum pectin (1.17 & 1.12%) was recorded in T_{12} followed by T_{10} (1.16 & 1.11%) and T_7 (1.13 & 1.08%) on initial day and 3rd day at storage conditions, respectively. Whereas, minimum pectin content (0.64 & 0.53%) was recorded in T_0 on initial day and 3rd day. In the next year, the maximum pectin (1.19 & 1.13%) was recorded with T_{12} followed by T_{10} (1.18 & 1.12%) and T_7 (1.15 & 1.10%) on initial day and 3rd day at storage conditions, respectively, minimum pectin content (0.63 & 0.52%) was recorded in T_0 on initial day and 3rd day storage, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that the maximum pectin content (1.18

& 1.12%) was recorded with T_{12} which was followed by T_{10} (1.17 & 1.11%) and T_7 (1.14 & 1.09%) on first day and 3rd day of storage conditions, respectively. However, minimum pectin content (0.63 & 0.53%) was recorded in control treatment. Interaction study found non-significant variation right from Ist day of storage to 9th days of storage conditions.

4.13.2 Pectin (%) on 6th and 9th day storage condition

On 6th days of storage in both years of experiment i.e. 2015-16 and 2016-17 found that non-significant variations. However, on 9th day of storage pooled data showed that maximum pectin (0.57%) was noted with Dharidar.

Application of plant growth regulator and nutrients showed that the maximum pectin (1.05 & 0.91%) was recorded in T_{12} followed by T_{10} (1.02 & 0.87%) and T_7 (0.99 & 0.82%) on 6th and 9th days at storage conditions, respectively, minimum pectin content (0.41 & 0.22%) was recorded in T_0 on 6th and 9th days, respectively in 2015-16. In the next year, the maximum pectin (1.07 & 0.93%) was recorded with T_{12} followed by T_{10} (1.03 & 0.89%) and T_7 (1.00 & 0.83%) on 6th and 9th days at storage conditions, respectively. However, minimum pectin content (0.40 & 0.20%) was recorded in control treatment. Pooled analysis of data 2015-16 and 2016-17 indicated that the maximum pectin content (1.06 & 0.92%) was recorded with T_{12} which was followed by T_{10} (1.02 & 0.88) and T_7 (0.99 & 0.83%) on 6th and 9th days of storage conditions, respectively. While, minimum pectin content (0.41 & 0.21%) was recorded in control.

Table 4.11: Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on pectin (%) at 3 day intervals up to 9 days storage

Treatments	Pectin (%)											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	0.91	0.93	0.92	0.84	0.85	0.84	0.73	0.75	0.74	0.57	0.57	0.57
V_2	0.89	0.91	0.90	0.82	0.83	0.83	0.72	0.73	0.73	0.55	0.55	0.55
S.Em. ±	**0.005**	**0.006**	**0.004**	**0.006**	**0.006**	**0.004**	**0.008**	**0.008**	**0.006**	**0.007**	**0.006**	**0.005**
CD (at 5%)	**0.010**	**0.017**	**0.012**	**0.019**	**0.017**	**0.012**	**NS**	**NS**	**NS**	**NS**	**0.019**	**0.013**
Plant growth regulator and nutrients												
T_0	0.64	0.63	0.63	0.53	0.52	0.53	0.41	0.40	0.41	0.22	0.20	0.21
T_1	0.67	0.68	0.67	0.58	0.58	0.58	0.47	0.46	0.46	0.27	0.26	0.27
T_2	0.70	0.71	0.70	0.62	0.61	0.61	0.50	0.50	0.50	0.31	0.29	0.30
T_3	0.90	0.92	0.91	0.85	0.86	0.86	0.77	0.79	0.78	0.61	0.62	0.61
T_4	1.08	1.10	1.09	1.03	1.05	1.04	0.95	0.96	0.95	0.79	0.80	0.79
T_5	0.75	0.75	0.75	0.64	0.65	0.65	0.51	0.52	0.52	0.32	0.32	0.32
T_6	0.80	0.81	0.80	0.70	0.71	0.71	0.58	0.59	0.59	0.39	0.40	0.39
T_7	1.13	1.15	1.14	1.08	1.10	1.09	0.99	1.00	0.99	0.82	0.83	0.83
T_8	0.82	0.83	0.82	0.74	0.76	0.75	0.62	0.63	0.62	0.44	0.45	0.45
T_9	0.94	0.95	0.94	0.88	0.90	0.89	0.80	0.81	0.80	0.64	0.65	0.65
T_{10}	1.16	1.18	1.17	1.11	1.12	1.11	1.02	1.03	1.02	0.87	0.89	0.88
T_{11}	1.00	1.02	1.01	0.93	0.95	0.94	0.83	0.87	0.85	0.69	0.71	0.70
T_{12}	1.17	1.19	1.18	1.12	1.13	1.12	1.05	1.07	1.06	0.91	0.93	0.92
S.Em. ±	**0.01**	**0.01**	**0.011**	**0.01**	**0.01**	**0.011**	**0.02**	**0.02**	**0.015**	**0.01**	**0.01**	**0.012**
CD (at 5%)	**0.04**	**0.04**	**0.031**	**0.05**	**0.04**	**0.031**	**0.06**	**0.06**	**0.042**	**0.05**	**0.04**	**0.034**

Interactions												
V_1T_0	0.64	0.63	0.63	0.54	0.53	0.54	0.42	0.41	0.42	0.23	0.21	0.22
V_1T_1	0.68	0.70	0.69	0.60	0.60	0.60	0.49	0.48	0.49	0.30	0.29	0.30
V_1T_2	0.70	0.71	0.70	0.62	0.61	0.62	0.51	0.51	0.51	0.33	0.31	0.32
V_1T_3	0.91	0.93	0.92	0.86	0.87	0.87	0.78	0.79	0.79	0.62	0.63	0.63
V_1T_4	1.09	1.11	1.10	1.03	1.05	1.04	0.94	0.95	0.95	0.79	0.80	0.80
V_1T_5	0.75	0.75	0.75	0.65	0.66	0.66	0.53	0.54	0.54	0.34	0.35	0.35
V_1T_6	0.80	0.81	0.81	0.71	0.72	0.71	0.58	0.59	0.59	0.39	0.40	0.40
V_1T_7	1.14	1.16	1.15	1.08	1.10	1.09	0.98	0.99	0.99	0.83	0.84	0.84
V_1T_8	0.82	0.83	0.83	0.72	0.73	0.73	0.59	0.60	0.60	0.40	0.41	0.41
V_1T_9	0.96	0.97	0.97	0.90	0.92	0.91	0.82	0.83	0.82	0.66	0.67	0.67
V_1T_{10}	1.18	1.20	1.19	1.12	1.13	1.13	1.03	1.04	1.03	0.89	0.90	0.90
V_1T_{11}	1.02	1.04	1.03	0.95	0.96	0.95	0.86	0.87	0.85	0.70	0.72	0.71
V_1T_{12}	1.19	1.20	1.19	1.13	1.15	1.14	1.06	1.08	1.07	0.91	0.93	0.92
V_2T_0	0.63	0.62	0.63	0.52	0.51	0.52	0.40	0.39	0.40	0.21	0.19	0.20
V_2T_1	0.66	0.66	0.66	0.55	0.55	0.55	0.44	0.43	0.44	0.24	0.23	0.24
V_2T_2	0.70	0.71	0.70	0.61	0.61	0.61	0.49	0.48	0.49	0.29	0.28	0.28
V_2T_3	0.90	0.92	0.91	0.84	0.86	0.85	0.76	0.78	0.77	0.60	0.61	0.60
V_2T_4	1.08	1.10	1.09	1.02	1.04	1.03	0.95	0.96	0.95	0.78	0.79	0.79
V_2T_5	0.74	0.75	0.75	0.63	0.64	0.64	0.50	0.50	0.50	0.30	0.29	0.30
V_2T_6	0.80	0.81	0.80	0.69	0.70	0.70	0.58	0.59	0.59	0.38	0.39	0.39
V_2T_7	1.12	1.14	1.13	1.07	1.09	1.08	0.99	1.01	1.00	0.82	0.83	0.82
V_2T_8	0.82	0.82	0.82	0.76	0.78	0.77	0.64	0.65	0.65	0.48	0.49	0.48
V_2T_9	0.91	0.93	0.92	0.85	0.87	0.86	0.78	0.79	0.79	0.62	0.63	0.63
V_2T_{10}	1.14	1.16	1.15	1.09	1.10	1.10	1.00	1.02	1.01	0.85	0.87	0.86
V_2T_{11}	0.97	0.99	0.98	0.91	0.93	0.92	0.84	0.86	0.85	0.68	0.70	0.69
V_2T_{12}	1.14	1.17	1.16	1.10	1.11	1.11	1.04	1.06	1.05	0.90	0.92	0.91
S.Em. ±	**0.02**	**0.02**	**0.01**	**0.02**	**0.02**	**0.01**	**0.03**	**0.03**	**0.02**	**0.02**	**0.02**	**0.01**
CD (at 5%)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

4.14 Sensory score

4.14.1 (a) Appearance on initial day and 3rd day storage condition

Fruit appearance is the most important parameter because it attracts the consumers visually and also influences the market price. Analysed data in 4.12 (a) and Fig 4.136 to 4.147 clearly showed that the highest appearance score (8.70) & (6.87) was recorded with Dharidar on initial day and 3rd day at storage condition in 2015-2016. In the following year i.e. 2016-17 the highest appearance scored (8.71) & (6.83) with Dharidar. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest score (8.71) & (6.85) with respect to appearance was registered in guava variety of Dharidar on Ist and 3rd day of storage conditions, respectively. Application of plant growth regulator and nutrients showed that the highest appearance (9.75) & (8.05) was scored with T_{12} which was closely followed by T_{11} (9.55) & (8.00) and T_8 (9.16) & (7.62) on Ist and 3rd day of storage conditions, respectively, minimum appearance score (7.85) & (5.20) was registered in T_0 (2015-16).In year 2016-17 the treatment T_{12} was registered highest appearance score (9.80) & (8.10) followed by T_8 (9.37) & (7.68) and T_{11} (9.35) & (7.55) on Ist and 3rd day of storage conditions, respectively minimum appearance score (7.65) & (5.04) was registered in T_0. Pooled analysis data revealed that the highest appearance (9.77) & (8.08) was scored with T_{12} on Ist and 3rd day of storage conditions, respectively. However, minimum appearance (7.75) & (5.12) scored with control treatment. Interaction study showed non-significant variations on first day of storage in year 2015-16, however on 3rd day of storage highest appearance (8.10) scored with V_1T_{12}, V_2T_{12} (8.00), V_2T_{11} (8.00) & V_1T_{11} (8.00) had equal performance with respect to appearance. However, minimum appearance (7.60) & (5.00) scored with control V_2T_0.In year 2016-17 treatment V_1T_{12} & V_2T_{12} was found the highest appearance score (9.80) which was followed by V_2T_{11} (9.60) and V_1T_8 (9.50) on Ist day of storage. On 3rd day of storage the highest appearance score (8.20) was registered in V_1T_{12} followed by (8.00) with V_2T_{12}, V_2T_{11} V_1T_7 & V_1T_8. Minimum appearance score (7.50) & (4.80) was obtained in V_2T_0 on first day & 3rd day at storage. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest appearance score (9.80) was noted with V_1T_{12} which was closely

followed by V_2T_{12} (9.75) and V_2T_{11} (9.55) on first day storage. On 3rd day of storage conditions the highest appearance (8.15) scored with V_1T_{12} which was closely followed by V_2T_{12} (8.00) and V_2T_{11} (8.00) respectively. However, the minimum appearance score (7.60) & (4.90) was obtained in V_2T_0 on Ist day and 3rd day storage, respectively.

4.14.2 (a) Appearance on 6th day and 9th day storage condition

The highest appearance score (4.91) & (2.92) was recorded with Dharidar on 6th and 9th days at storage condition in 2015-2016. In the following year i.e. 2016-17 the highest appearance scored (4.87) & (2.91) with Dharidar. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest score (4.89) & (2.91) with respect to appearance was registered in guava variety of Dharidar on 6th and 9th days of storage conditions, respectively.

Application of plant growth regulator and nutrients showed that the highest appearance (6.16) & (4.72) was scored with T_{12} which was closely followed by T_{11} (6.11) & (4.60) on 6th & 9th days , minimum appearance (3.05) & (1.10) was scored in T_0 on 6th and 9th days of storage conditions, respectively in year 2015-16. In next year, treatment T_{12} was registered highest appearance score (6.20) & (4.73) on 6th and 9th days of storage conditions. However, the minimum value as regards to appearance was registered in control Pooled analysis of data 2015-16 and 2016-17 indicated that the highest score (6.18) & (4.72) with respect to appearance was registered in T_{12} which was closely followed by T_{11} (5.86) & (4.43), lowest appearance (3.00) & (1.07) was scored in T_0 on 6th & 9th days storage. Interaction study showed that the highest appearance score (6.22) was registered with V_1T_{12} which was closely followed by V_1T_{11} (6.21) and V_1T_{12} (6.10) on 6th day of storage condition. On 9th day of storage condition, highest appearance score (4.75) was noted in V_1T_{12} followed by V_2T_{12} & V_1T_{11} (4.70) and V_2T_{11} (4.50) respectively, minimum appearance (2.90) & (1.08) was scored in V_2T_0 on 6th and 9th days storage (2015-16).

Table 4.12 (a): Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on appearance at 3 day intervals up to 9 days storage

Treatments	Appearance											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	8.70	8.71	8.71	6.87	6.83	6.85	4.91	4.87	4.89	2.92	2.91	2.91
V_2	8.60	8.65	8.63	6.62	6.65	6.64	4.78	4.83	4.80	2.86	2.89	2.87
S.Em. ±	**0.016**	**0.005**	**0.008**	**0.009**	**0.007**	**0.006**	**0.013**	**0.004**	**0.007**	**0.012**	**0.004**	**0.006**
CD (at 5%)	**0.048**	**0.014**	**0.023**	**0.025**	**0.021**	**0.016**	**0.038**	**0.012**	**0.019**	**0.034**	**0.013**	**0.017**
Plant growth regulator and nutrients												
T_0	7.85	7.65	7.75	5.20	5.04	5.12	3.05	2.95	3.00	1.10	1.05	1.07
T_1	8.50	8.65	8.57	6.35	6.38	6.37	5.05	5.09	5.07	2.00	2.02	2.01
T_2	8.85	8.83	8.84	6.60	6.63	6.62	5.20	5.22	5.21	2.18	2.22	2.20
T_3	7.85	7.95	7.90	5.84	5.93	5.89	3.70	3.71	3.70	1.58	1.64	1.61
T_4	7.91	8.00	7.95	5.91	5.90	5.91	3.75	3.77	3.76	1.64	1.69	1.66
T_5	8.00	8.03	8.01	6.00	6.03	6.01	3.96	4.07	4.02	1.98	2.04	2.01
T_6	8.01	8.07	8.04	6.33	6.36	6.34	4.01	4.07	4.04	2.05	2.08	2.06
T_7	9.10	9.15	9.12	7.50	7.56	7.53	5.45	5.52	5.49	4.02	4.08	4.05
T_8	9.16	9.37	9.26	7.62	7.68	7.65	5.51	5.63	5.57	4.07	4.20	4.13
T_9	9.00	9.03	9.02	7.30	7.33	7.32	5.55	5.61	5.58	3.79	3.80	3.79
T_{10}	8.95	9.00	8.98	7.05	7.08	7.06	5.46	5.60	5.53	3.81	3.88	3.85
T_{11}	9.55	9.35	9.45	8.00	7.55	7.78	6.11	5.61	5.86	4.60	4.25	4.43
T_{12}	9.75	9.80	9.77	8.05	8.10	8.08	6.16	6.20	6.18	4.72	4.73	4.72
S.Em. ±	**0.04**	**0.01**	**0.021**	**0.02**	**0.01**	**0.014**	**0.03**	**0.01**	**0.017**	**0.03**	**0.01**	**0.016**
CD (at 5%)	**0.12**	**0.03**	**0.059**	**0.06**	**0.05**	**0.040**	**0.09**	**0.03**	**0.048**	**0.08**	**0.03**	**0.044**

Interactions												
V_1T_0	8.00	7.80	7.90	5.39	5.28	5.34	3.19	3.10	3.15	1.12	1.10	1.11
V_1T_1	8.60	8.80	8.70	6.50	6.52	6.51	5.10	5.08	5.09	2.10	2.12	2.11
V_1T_2	8.90	8.80	8.85	6.80	6.82	6.81	5.30	5.33	5.32	2.36	2.38	2.37
V_1T_3	7.90	8.00	7.95	5.80	5.86	5.83	3.80	3.82	3.81	1.50	1.60	1.55
V_1T_4	7.92	8.00	7.96	5.90	5.80	5.85	3.85	3.89	3.87	1.56	1.62	1.59
V_1T_5	8.00	8.06	8.03	6.00	6.04	6.02	4.00	4.20	4.10	2.00	2.10	2.05
V_1T_6	8.02	8.10	8.06	6.35	6.41	6.38	4.08	4.18	4.13	2.10	2.16	2.13
V_1T_7	9.20	9.26	9.23	7.90	8.00	7.95	5.90	6.02	5.96	4.03	4.10	4.07
V_1T_8	9.30	9.50	9.40	7.92	8.00	7.96	5.91	6.06	5.99	4.10	4.21	4.16
V_1T_9	9.00	9.06	9.03	7.60	7.65	7.62	5.20	5.22	5.21	3.80	3.80	3.80
V_1T_{10}	8.90	9.00	8.95	7.09	7.10	7.10	5.00	5.10	5.05	3.82	3.90	3.86
V_1T_{11}	9.60	9.10	9.35	8.00	7.11	7.55	6.21	5.12	5.67	4.70	3.95	4.32
V_1T_{12}	9.80	9.80	9.80	8.10	8.20	8.15	6.22	6.25	6.24	4.75	4.73	4.74
V_2T_0	7.70	7.50	7.60	5.00	4.80	4.90	2.90	2.80	2.85	1.08	1.00	1.04
V_2T_1	8.40	8.50	8.45	6.20	6.25	6.23	5.00	5.10	5.05	1.90	1.92	1.91
V_2T_2	8.80	8.86	8.83	6.40	6.45	6.43	5.10	5.12	5.11	2.00	2.06	2.03
V_2T_3	7.80	7.90	7.85	5.89	6.00	5.95	3.60	3.59	3.60	1.66	1.67	1.67
V_2T_4	7.90	8.00	7.95	5.92	6.00	5.96	3.65	3.66	3.65	1.72	1.75	1.74
V_2T_5	8.00	8.00	8.00	6.00	6.01	6.01	3.92	3.94	3.93	1.96	1.98	1.97
V_2T_6	8.00	8.03	8.02	6.30	6.31	6.31	3.94	3.95	3.95	2.00	2.00	2.00
V_2T_7	9.00	9.03	9.02	7.10	7.12	7.11	5.00	5.02	5.01	4.00	4.06	4.03
V_2T_8	9.02	9.23	9.13	7.32	7.36	7.34	5.10	5.20	5.15	4.04	4.18	4.11
V_2T_9	9.00	9.00	9.00	7.00	7.02	7.01	5.90	6.00	5.95	3.78	3.79	3.78
V_2T_{10}	9.00	9.00	9.00	7.00	7.06	7.03	5.92	6.10	6.01	3.80	3.86	3.83
V_2T_{11}	9.50	9.60	9.55	8.00	8.00	8.00	6.00	6.10	6.05	4.50	4.56	4.53
V_2T_{12}	9.70	9.80	9.75	8.00	8.00	8.00	6.10	6.16	6.13	4.70	4.72	4.71
S.Em. ±	**0.06**	**0.01**	**0.02**	**0.03**	**0.02**	**0.02**	**0.04**	**0.01**	**0.02**	**0.04**	**0.01**	**0.02**
CD (at 5%)	**NS**	**0.05**	**0.08**	**0.09**	**0.07**	**0.05**	**0.13**	**0.04**	**0.06**	**0.12**	**0.04**	**0.04**

In following year i.e. 2016-17 revealed that highest appearance score (6.25) was registered with V_1T_{12} followed by V_2T_{12} (6.16) on 6th day of storage. On 9th day of storage condition, highest appearance score (4.73) was noted in V_1T_{12} followed by V_2T_{12} (4.72) and V_2T_{11} (4.56). While, lowest appearance (2.80) & (1.00) was noted in V_2T_0. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest score (6.24) & (4.74) with respect to appearance was registered in V_1T_{12} which was followed by V_2T_{12} (6.13) & (4.71) and V_2T_{11} (6.05) & (4.53). However, the minimum values with relation to appearance score (2.85) & (1.04) was registered in V_2T_0.

4.15.1 (b) Taste on initial day and 3rd day storage condition

Fruit taste is the most important parameter for consumers and taste also influences the market price. Analysed data in Table 4.12 (b) and Fig. 4.148 to 4.159 clearly showed that the highest taste score (8.52) was recorded with Chittidar on initial day storage condition and on 3rd day of storage highest taste score (7.31) was obtained with Dharidar in 2015-2016. In the following year i.e. 2016-17 the highest taste scored (8.58) & (7.39) with Dharidar. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest score (8.55) & (7.35) with respect to taste was registered in guava variety of Dharidar on Ist and 3rd day of storage conditions, respectively. Application of plant growth regulator and nutrients showed that the highest taste (8.95) & (7.95) was scored with T_{12} which was closely followed by T_{10} (8.90) & (7.80) on Ist and 3rd day of storage conditions, lowest taste score (7.90) was noted in T_1 & T_0 on Ist day and (6.75) on 3rd day, respectively (2015-16). In year 2016-17 the treatment T_{12} was registered highest taste score (9.05) & (8.05) followed by T_{10} (9.00) & (7.84) on Ist and 3rd day of storage condition, lowest score (8.00) & (6.26) was noted in T_0 on Ist and 3rd days of storage condition, respectively. Pooled analysis of data 2015-16 and 2016-17 revealed that highest taste score (9.00) & (8.00) was found in T_{12} which was followed by T_{10} (8.95) & (7.82) and minimum taste score (7.95) in T_1 on Ist and (6.51) in T_0 on 3rd day at storage. Interaction study revealed that the highest taste score (9.00) and (8.00) was obtained in V_2T_{12}which was followed by V_1T_{12} (8.90) & (7.90) on Ist and 3rd day of storage conditions, lowest taste score (6.70) was noted in V_2T_0 on 3rd day, respectively in year

2015-16. In year 2016-17 treatment V_2T_{12} was found the highest taste score (9.10) & (8.10) followed by $V_1T_{12,}$ (9.00) & (8.00) on Ist and 3rd day of storage conditions, lowest taste score (7.80) was noted in V_2T_2 on Ist and (6.70) in V_2T_1 & V_2T_2 respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest taste score (9.05) & (8.05) was noted with V_2T_{12} which was closely followed by V_1T_{12} (8.95) & V_1T_{12} (7.95) on first day and 3rd day of storage conditions, respectively. However, lowest taste score (7.80) was noted in V_2T_2 on Ist and (6.20) in V_2T_0 on 3rd day at storage.

4.15.2 (b) Taste on 6th day and 9th day storage condition

The highest taste score (5.80) & (3.49) was recorded with Chittidar on 6th and 9th days at storage condition in 2015-2016. In the following year i.e. 2016-17 the highest taste scored (5.90) & (3.51) with Chittidar. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest score (5.85) & (3.50) with respect to taste was registered in guava variety of Chittidar on 6th and 9th days of storage conditions, respectively. Application of plant growth regulator and nutrients showed that the highest taste score (6.95) & (5.33) was noted with T_{12} which was closely followed by T_{10} (6.81) & (5.24) on 6th and 9th days of storage conditions, lowest taste score (4.30) & (1.25) was noted in T_0 on 6th & 9th days at storage, respectively in year 2015-16. In next year, treatment T_{12} was registered highest taste score (7.00) & (5.34) on 6th and 9th days of storage conditions, lowest taste score (4.05) & (1.06) was noted in T_0. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest score (6.98) with respect to taste was registered in T_{12} which was closely followed by T_{11} (6.95) and T_{10} (6.82) on 6th day of storage and on 9th day of storage the highest taste score (5.33) was obtained in T_{12} followed by T_{10} (5.28 and T_{10} (5.28), respectively. However, lowest taste score (4.17) & (1.15) was noted in control treatment.

Table 4.12 (b): Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on taste at 3 day intervals up to 9 days storage

Treatments	Taste											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	8.52	8.58	8.55	7.31	7.39	7.35	5.69	5.74	5.72	3.28	3.30	3.29
V_2	8.43	8.51	8.47	7.27	7.25	7.26	5.80	5.90	5.85	3.49	3.51	3.50
S.Em. ±	**0.026**	**0.005**	**0.013**	**0.011**	**0.006**	**0.006**	**0.008**	**0.005**	**0.005**	**0.008**	**0.004**	**0.005**
CD (at 5%)	**0.075**	**0.015**	**0.036**	**0.031**	**0.016**	**0.016**	**0.023**	**0.016**	**0.013**	**0.025**	**0.013**	**0.013**
Plant growth regulator and nutrients												
T_0	8.05	8.00	8.02	6.75	6.26	6.51	4.30	4.05	4.17	1.25	1.06	1.15
T_1	7.90	8.00	7.95	6.82	6.85	6.83	4.32	4.40	4.36	1.60	1.62	1.61
T_2	7.91	8.03	7.97	6.85	6.90	6.87	4.57	4.63	4.60	1.73	1.78	1.75
T_3	8.10	8.18	8.14	7.00	7.11	7.05	4.89	4.95	4.92	2.45	2.47	2.46
T_4	8.25	8.21	8.23	7.01	7.15	7.08	5.06	5.11	5.09	2.66	2.73	2.69
T_5	8.55	8.63	8.59	7.40	7.50	7.45	5.85	5.90	5.88	3.38	3.43	3.40
T_6	8.70	8.80	8.75	7.50	7.54	7.52	6.45	6.47	6.46	3.46	3.52	3.49
T_7	8.50	8.54	8.52	7.15	7.18	7.16	5.97	6.00	5.98	3.06	3.11	3.08
T_8	8.80	8.83	8.82	7.50	7.60	7.55	6.50	6.54	6.52	4.80	4.83	4.82
T_9	8.80	8.90	8.85	7.50	7.61	7.55	6.37	6.55	6.46	4.24	4.24	4.24
T_{10}	8.90	9.00	8.95	7.80	7.84	7.82	6.81	6.84	6.82	5.24	5.33	5.28
T_{11}	8.80	8.88	8.84	7.55	7.59	7.57	6.68	7.23	6.95	4.78	4.84	4.81
T_{12}	8.95	9.05	9.00	7.95	8.05	8.00	6.95	7.00	6.98	5.33	5.34	5.33
S.Em. ±	**0.06**	**0.01**	**0.033**	**0.03**	**0.01**	**0.01**	**0.02**	**0.01**	**0.012**	**0.02**	**0.01**	**0.012**
CD (at 5%)	**0.19**	**0.04**	**0.091**	**0.08**	**0.04**	**0.04**	**0.05**	**0.04**	**0.034**	**0.06**	**0.03**	**0.034**

Interactions												
V_1T_0	8.20	8.00	8.10	6.80	6.82	6.81	4.30	4.10	4.20	1.30	1.10	1.20
V_1T_1	8.00	8.10	8.05	6.98	7.00	6.99	4.25	4.30	4.27	1.80	1.82	1.81
V_1T_2	8.20	8.26	8.23	6.99	7.10	7.05	4.35	4.40	4.37	1.95	1.96	1.96
V_1T_3	8.30	8.35	8.33	7.00	7.15	7.08	4.86	4.90	4.88	2.09	2.10	2.10
V_1T_4	8.30	8.12	8.21	7.00	7.20	7.10	5.03	5.11	5.07	2.11	2.16	2.13
V_1T_5	8.50	8.60	8.55	7.40	7.50	7.45	5.50	5.58	5.54	3.35	3.40	3.38
V_1T_6	8.70	8.80	8.75	7.50	7.56	7.53	6.40	6.42	6.41	3.42	3.48	3.45
V_1T_7	8.60	8.62	8.61	7.10	7.10	7.10	5.95	6.00	5.97	3.03	3.09	3.06
V_1T_8	8.80	8.86	8.83	7.50	7.60	7.55	6.50	6.56	6.53	4.62	4.67	4.64
V_1T_9	8.80	8.90	8.85	7.50	7.60	7.55	6.55	6.70	6.62	3.69	3.70	3.69
V_1T_{10}	8.90	9.00	8.95	7.80	7.86	7.83	6.82	6.86	6.84	5.18	5.30	5.24
V_1T_{11}	8.80	8.90	8.85	7.50	7.56	7.53	6.60	6.65	6.62	4.76	4.80	4.78
V_1T_{12}	8.90	9.00	8.95	7.90	8.00	7.95	6.92	7.00	6.96	5.30	5.32	5.31
V_2T_0	7.90	8.00	7.95	6.70	5.70	6.20	4.30	4.00	4.15	1.20	1.02	1.11
V_2T_1	7.80	7.90	7.85	6.65	6.70	6.68	4.40	4.50	4.45	1.40	1.42	1.41
V_2T_2	7.80	7.80	7.80	6.70	6.70	6.70	4.80	4.86	4.83	1.50	1.60	1.55
V_2T_3	7.90	8.00	7.95	7.00	7.06	7.03	4.92	5.00	4.96	2.80	2.84	2.82
V_2T_4	8.20	8.30	8.25	7.01	7.10	7.06	5.09	5.12	5.11	3.20	3.30	3.25
V_2T_5	8.60	8.65	8.63	7.40	7.50	7.45	6.20	6.22	6.21	3.40	3.45	3.43
V_2T_6	8.70	8.80	8.75	7.50	7.52	7.51	6.50	6.52	6.51	3.50	3.56	3.53
V_2T_7	8.40	8.46	8.43	7.20	7.26	7.23	5.98	6.00	5.99	3.09	3.12	3.11
V_2T_8	8.80	8.80	8.80	7.50	7.60	7.55	6.50	6.52	6.51	4.98	5.00	4.99
V_2T_9	8.80	8.90	8.85	7.50	7.62	7.56	6.20	6.40	6.30	4.79	4.78	4.78
V_2T_{10}	8.90	9.00	8.95	7.80	7.82	7.81	6.79	6.82	6.81	5.30	5.36	5.33
V_2T_{11}	8.80	8.86	8.83	7.60	7.62	7.61	6.76	7.80	7.28	4.80	4.88	4.84
V_2T_{12}	9.00	9.10	9.05	8.00	8.10	8.05	6.98	7.00	6.99	5.35	5.36	5.36
S.Em. ±	**0.09**	**0.02**	**0.04**	**0.04**	**0.02**	**0.02**	**0.02**	**0.02**	**0.01**	**0.03**	**0.01**	**0.01**
CD (at 5%)	**NS**	**0.05**	**0.12**	**0.11**	**0.06**	**0.06**	**0.08**	**0.05**	**0.04**	**0.09**	**0.04**	**0.04**

Interaction study showed that the highest taste score (6.98) was registered with V_2T_{12} which was closely followed by V_1T_{11} (6.92) and V_1T_{10} (6.82) on 6th day of storage condition. On 9th day storage highest taste score (5.35) was obtained with V_2T_{12} which was closely followed by V_2T_{10} (5.30) & V_1T_{12} (5.30), lowest taste score (4.25) was noted in V_1T_1 on 6th days and (1.20) was noted in V_2T_0 on 9th day storage respectively (2015-16).In following year i.e. 2016-17 revealed that highest taste score (7.80) was obtained with V_2T_{11} followed by V_2T_{12} (7.00) & V_1T_{12} (7.00) on 6th day of storage. On 9th day of storage condition, highest taste score (5.36) was noted in V_2T_{12} & V_2T_{10} followed by V_1T_{12} (5.32) and V_1T_{10} (5.30), lowest taste score (4.00) & (1.02) was noted in V_2T_{10}, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest score (7.28) with respect to taste was obtained in V_2T_{11} which was followed by V_2T_{12} (6.99) and V_1T_{12} (6.96) on 6th day storage conditions. On 9th day storage conditions the highest taste score (5.36) was obtained with V_2T_{12} which was closely followed by V_2T_{10} (5.33) and V_1T_{12} (5.31). However, the minimum values with relation to taste score (4.15) & (1.11) was registered in V_2T_0 treatment.

4.16.1 (c) Flavour on initial day and 3rd day storage condition

Fruit flavour is the most important parameter for consumers. Resulted data in Table 4.12 (c) and Fig. 4.160 to 4.171 clearly showed that the highest flavour score (6.41) was recorded with Dharidar on initial day storage condition and on 3rd day of storage highest flavour score (7.56) was obtained with Chittidar in 2015-2016. In the following year i.e. 2016-17 the highest flavour score (6.48) was recorded with Dharidar on initial day storage condition and on 3rd day of storage highest flavour score (7.62) was obtained with Chittidar. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest score (6.44) with respect to flavour was registered in guava variety of Dharidar on Ist and on 3rd day of storage highest flavour score (7.62) was obtained with Chittidar (V_2), respectively. Application of plant growth regulator and nutrients showed that the highest flavour score (7.41) & (9.05) was scored with T_{12} which was closely followed by T_{11} (7.29) & (8.81) on Ist and 3rd days of storage conditions, respectively (2015-16). In year 2016-17 the treatment T_{12} was registered highest taste score (7.49) & (9.05) followed by

T_{11} (7.36) & (8.84) on Ist and 3rd days of storage conditions, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest flavour score (7.45) & (9.05) was obtained in T_{12} which was followed by T_{11} (7.33 & (8.83) and T_{10} (7.24) & (8.70) on Ist and on 3rd day of storage. However, the lowest flavour score was noted in control treatment in both years. Interaction study indicated that the highest flavour score (7.90) was obtained in V_1T_{12} which was followed by V_1T_{11} (7.82) & V_1T_{10} (7.56) on Ist day of storage conditions and on 3rd day of storage the highest flavour score (9.09) was obtained in V_1T_{12} followed V_2T_{12} (9.00) and V_1T_{11} (8.96) respectively, lowest flavour score (5.10) & (6.39) was noted under V_1T_0 in year 2015-16. In year 2016-17 treatment V_1T_{12} was found the highest flavour score (8.00) with V_1T_{12} followed by V_1T_{11} (7.90) & V_1T_{10} (7.60) on Ist day of storage conditions on 3rd day of storage the highest flavour score (9.10) was obtained in V_2T_{12} followed by V_1T_{12} (9.00) and V_1T_{11} (8.98), respectively, lowest flavour score (5.20) & (5.90) was noted under V_1T_0. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest flavour score (7.95) was noted with V_1T_{12} which was closely followed by V_1T_{11} (7.86) & V_1T_{10} (7.58) on first day of storage on 3rd day storage the highest flavour score (9.05) was obtained in V_1T_{12} & V_1T_{12} followed by V_1T_{11} 8.97) & V_1T_{10} (8.83) respectively. However, lowest flavour (5.15) & (6.15) was noted in V_1T_0.

4.16.2 (c) Flavour on 6th day and 9th day storage condition

The highest flavour score (6.78) & (3.77) was recorded with Dharidar on 6th and 9th days at storage condition in 2015-2016. In the following year i.e. 2016-17 the highest flavour scored (6.77) & (3.77) with Dharidar (V_1). Pooled analysis of data 2015-16 and 2016-17 indicated that the highest flavour score (6.78) & (3.77) was registered in guava variety of Dharidar on 6th and 9th days of storage conditions, respectively. Application of plant growth regulator and nutrients showed that the highest flavour (7.75) & (4.73) was scored with T_{12} which was closely followed by T_{11} (7.72) & (4.54) on 6th and 9th days of storage conditions, respectively in year 2015-16. In next year, treatment T_{12} was registered highest flavour score (7.78) & (4.74) followed by T_{11} (7.75) & (4.56) on 6th and 9th days of storage conditions. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest flavour score (7.77) & (4.73) with

respect to flavour was registered in T_{12} which was closely followed by T_{11} (7.73) & (4.55) and T_{10} (7.32) & (4.39) on 6th and 9th days of storage, respectively. While, lowest flavour score was noted in control treatment in both years of experiment. Interaction study showed that the highest flavour score (7.90) was registered with V_1T_{12} & V_2T_{12} which was closely followed by V_1T_{11} (7.85) and V_1T_{10} (7.80) on 6th day of storage condition. On 9th day of storage condition, highest flavour score (4.80) was noted in V_1T_{12} followed by V_1T_{10} (4.69) & V_2T_{12} (4.65) on 9th day at storage, lowest flavour score (5.42) & (1.20) was noted in V_2T_0 on 6th day & 9th day storage, respectively (2015-2016). In following year i.e. 2016-17 revealed that highest flavour score (7.92) was obtained with V_1T_{12} followed by V_1T_{11} (7.90) & V_1T_{10} (7.82) on 6th days of storage. On 9th day of storage condition, highest flavour score (4.78) was noted in V_1T_{12} followed by V_1T_{10} & V_2T_{12} (4.70), respectively. Lowest flavour score (4.98) on 6th day & (1.00) on 9th day was noted in V_1T_0 & V_2T_0 respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest flavour score (7.91) with respect to taste was obtained in V_1T_{12} which was followed by V_1T_{11} (7.88) and V_1T_{10} (7.81) on 6th day storage conditions. On 9th day storage conditions the highest flavour score (4.79) was obtained with V_1T_{12} which was closely followed by V_1T_{10} (4.69) and V_2T_{12} (4.67). However, the minimum values with relation to flavour score (5.27) & (1.10) was registered in V_2T_0 treatments.

4.17.1 (d) Texture on initial day and 3rd day storage condition

Data presented in Table 4.12 (d) and Fig. 4.172 to 4.183 clearly showed that the texture score (7.89) & (6.92) was obtained with Dharidar on initial and 3rd day of storage, respectively in 2015-2016. In the following year i.e. 2016-17 the highest texture score (7.95) & (6.94) was scored with Dharidar on initial day and 3rd day of storage Pooled analysis of data 2015-16 and 2016-17 indicated that the highest texture score (7.92) & (6.93) was registered in guava variety of Dharidar on Ist and 3rd days storage, respectively. Application of plant growth regulator and nutrients showed that the highest texture score (8.55) was scored with T_{12} & T_{10} which was closely followed by T_{11} (8.40) on Ist day storage on 3rd day of storage the highest texture score (7.75) was obtained in T_{12} followed by T_{10} (7.70) and T_{11}

(7.25), respectively (2015-16). In year 2016-17 the treatment T_{12} & T_{10} was obtained highest texture score (8.64) followed by T_{11} (8.50) on I^{st} day storage and on 3^{rd} day of storage condition the highest texture score (7.83) was obtained in T_{12} followed by T_{10} (7.77) and T_{11} (7.31), respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest texture score (8.60) was obtained in T_{12} which was followed by T_{11} (8.45) and T_9 (8.20) on I st and on 3^{rd} day of storage highest texture score (7.79) was obtained with T_{12} followed by T_{10} (7.73 and T_{11} (7.28), respectively. However, lowest texture score was found in control treatment. Interaction study indicated that the highest texture score (8.60) was obtained in V_1T_{12} & V_1T_{10} which was followed by V_1T_{12} & V_1T_{11} (8.50) on I^{st} day of storage conditions and on 3^{rd} day of storage the highest texture score (7.80) was obtained in V_1T_{12} followed V_2T_{12} (7.70) and V_1T_{10} (7.70), respectively, lowest texture score (6.50) & (5.40) was found under V_2T_0 on first day & 3^{rd} days at storage, respectively in year 2015-16. In year 2016-17 treatment V_1T_{12} was found the highest texture score (8.70) with V_1T_{12} followed by V_1T_{10} (8.68) & V_1T_{11} (8.58) & V_2T_{12} (8.58) on I^{st} day of storage conditions on 3^{rd} day of storage the highest texture score (7.90) was obtained in V_1T_{12} followed by V_1T_{10} (7.78) and V_2T_{12} (7.76) respectively, lowest texture score (6.56) & (5.40) was found under V_2T_0 on first day & 3^{rd} day at storage, respectively. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest texture score (8.65) was noted with V_1T_{12} which was closely followed by V_1T_{10} (8.64) on first day of storage, on 3^{rd} day storage the highest texture score (7.85) was obtained in V_1T_{12} followed by V_1T_{10} (7.74) & V_2T_{12} (7.73), respectively. However, lowest texture score (6.53) & (5.40) was found in V_2T_0 first day & 3^{rd} day at storage, respectively.

Table 4.12 (c): Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on flavour at 3 day intervals up to 9 days storage

Treatments	Flavour											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	6.41	6.48	6.44	7.56	7.48	7.52	6.78	6.77	6.78	3.77	3.77	3.77
V_2	6.34	6.40	6.37	7.62	7.62	7.62	6.44	6.41	6.43	3.40	3.34	3.37
S.Em. ±	**0.008**	**0.008**	**0.006**	**0.007**	**0.005**	**0.005**	**0.008**	**0.014**	**0.008**	**0.008**	**0.005**	**0.005**
CD (at 5%)	**0.024**	**0.022**	**0.016**	**0.022**	**0.015**	**0.013**	**0.025**	**0.041**	**0.022**	**0.025**	**0.014**	**0.014**
Plant growth regulator and nutrients												
T_0	5.20	5.30	5.25	6.44	6.10	6.27	5.59	5.05	5.32	1.30	1.05	1.17
T_1	5.72	5.74	5.73	6.79	6.76	6.78	6.06	6.09	6.07	2.88	2.92	2.90
T_2	5.87	5.93	5.90	6.84	6.85	6.85	6.20	6.20	6.20	3.05	3.04	3.04
T_3	6.00	6.08	6.04	7.00	7.06	7.03	6.00	6.00	6.00	3.13	3.15	3.14
T_4	6.16	6.20	6.18	7.07	6.68	6.88	6.38	6.35	6.36	3.26	3.29	3.27
T_5	6.14	6.20	6.17	7.21	7.20	7.21	6.44	6.45	6.45	3.78	3.50	3.64
T_6	6.27	6.29	6.28	7.56	7.61	7.59	6.60	6.66	6.63	3.89	3.89	3.89
T_7	6.23	6.29	6.26	7.40	7.43	7.41	6.26	6.36	6.31	3.73	3.73	3.73
T_8	6.36	6.45	6.41	7.65	7.66	7.65	6.49	6.48	6.48	3.87	3.85	3.86
T_9	7.03	7.08	7.05	8.18	8.23	8.21	7.17	7.23	7.20	4.09	4.12	4.11
T_{10}	7.23	7.26	7.24	8.67	8.73	8.70	7.30	7.34	7.32	4.39	4.39	4.39
T_{11}	7.29	7.36	7.33	8.81	8.84	8.83	7.72	7.75	7.73	4.54	4.56	4.55
T_{12}	7.41	7.49	7.45	9.05	9.05	9.05	7.75	7.78	7.77	4.73	4.74	4.73
S.Em. ±	**0.02**	**0.02**	**0.014**	**0.02**	**0.01**	**0.01**	**0.02**	**0.03**	**0.020**	**0.02**	**0.01**	**0.012**
CD (at 5%)	**0.06**	**0.05**	**0.040**	**0.06**	**0.04**	**0.03**	**0.06**	**0.10**	**0.057**	**0.06**	**0.03**	**0.035**

Interactions												
V_1T_0	5.10	5.20	5.15	6.39	5.90	6.15	5.76	4.98	5.37	1.40	1.10	1.25
V_1T_1	5.62	5.60	5.61	6.69	6.70	6.69	6.15	6.20	6.17	3.00	3.06	3.03
V_1T_2	5.83	5.86	5.85	6.72	6.80	6.76	6.30	6.40	6.35	3.30	3.38	3.34
V_1T_3	5.90	5.96	5.93	6.80	6.82	6.81	6.35	6.40	6.37	3.19	3.20	3.19
V_1T_4	5.95	6.00	5.98	6.89	6.06	6.48	6.45	6.50	6.48	3.35	3.40	3.38
V_1T_5	6.10	6.20	6.15	7.22	7.30	7.26	6.80	6.90	6.85	4.00	4.00	4.00
V_1T_6	6.12	6.18	6.15	7.60	7.66	7.63	6.89	6.92	6.91	4.10	4.12	4.11
V_1T_7	6.00	6.08	6.04	7.13	7.16	7.15	6.00	6.12	6.06	4.00	4.00	4.00
V_1T_8	6.16	6.30	6.23	7.49	7.50	7.50	6.36	6.35	6.36	4.18	4.20	4.19
V_1T_9	7.26	7.30	7.28	8.50	8.56	8.53	7.60	7.65	7.63	4.39	4.42	4.41
V_1T_{10}	7.56	7.60	7.58	8.80	8.86	8.83	7.80	7.82	7.81	4.69	4.70	4.69
V_1T_{11}	7.82	7.90	7.86	8.96	8.98	8.97	7.85	7.90	7.88	4.62	4.65	4.64
V_1T_{12}	7.90	8.00	7.95	9.09	9.00	9.05	7.90	7.92	7.91	4.80	4.78	4.79
V_2T_0	5.30	5.40	5.35	6.48	6.30	6.39	5.42	5.11	5.27	1.20	1.00	1.10
V_2T_1	5.82	5.88	5.85	6.90	6.82	6.86	5.96	5.98	5.97	2.76	2.78	2.77
V_2T_2	5.90	6.00	5.95	6.96	6.90	6.93	6.10	6.00	6.05	2.79	2.70	2.75
V_2T_3	6.10	6.20	6.15	7.20	7.30	7.25	5.65	5.60	5.62	3.06	3.10	3.08
V_2T_4	6.36	6.40	6.38	7.25	7.30	7.28	6.30	6.20	6.25	3.16	3.18	3.17
V_2T_5	6.18	6.20	6.19	7.20	7.10	7.15	6.09	6.00	6.04	3.56	3.00	3.28
V_2T_6	6.42	6.40	6.41	7.52	7.56	7.54	6.32	6.40	6.36	3.69	3.65	3.67
V_2T_7	6.46	6.50	6.48	7.66	7.70	7.68	6.52	6.60	6.56	3.45	3.46	3.46
V_2T_8	6.56	6.60	6.58	7.80	7.82	7.81	6.62	6.60	6.61	3.56	3.50	3.53
V_2T_9	6.80	6.86	6.83	7.86	7.90	7.88	6.74	6.80	6.77	3.79	3.82	3.81
V_2T_{10}	6.89	6.92	6.90	8.54	8.60	8.57	6.80	6.86	6.83	4.10	4.08	4.09
V_2T_{11}	6.76	6.82	6.79	8.66	8.70	8.68	7.58	7.60	7.59	4.46	4.46	4.46
V_2T_{12}	6.92	6.98	6.95	9.00	9.10	9.05	7.60	7.65	7.63	4.65	4.70	4.67
S.Em. ±	**0.03**	**0.02**	**0.02**	**0.03**	**0.02**	**0.02**	**0.03**	**0.05**	**0.02**	**0.03**	**0.01**	**0.01**
CD (at 5%)	**0.08**	**0.08**	**0.05**	**0.08**	**0.05**	**0.05**	**0.09**	**0.14**	**0.08**	**0.09**	**0.05**	**0.04**

Table 4.12 (d): Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on texture at 3 day intervals up to 9 days storage

Treatments	Texture											
	0 day			3 day			6 day			9 day		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
Varieties												
V_1	7.89	7.95	7.92	6.92	6.94	6.93	5.65	5.68	5.66	3.05	3.05	3.05
V_2	7.42	7.53	7.47	6.41	6.46	6.44	5.13	5.18	5.16	2.92	2.90	2.91
S.Em. ±	**0.01**	**0.005**	**0.009**	**0.01**	**0.007**	**0.006**	**0.01**	**0.005**	**0.006**	**0.01**	**0.005**	**0.007**
CD (at 5%)	**0.04**	**0.01**	**0.026**	**0.03**	**0.02**	**0.017**	**0.03**	**0.01**	**0.017**	**0.03**	**0.01**	**0.018**
Plant growth regulator and nutrients												
T_0	6.85	6.78	6.82	5.60	5.70	5.65	3.92	3.96	3.94	1.28	1.25	1.26
T_1	7.40	7.51	7.45	6.30	6.50	6.40	5.35	5.40	5.37	2.68	2.69	2.68
T_2	7.55	7.63	7.59	6.75	6.70	6.72	5.91	5.97	5.94	2.93	2.92	2.93
T_3	7.20	7.30	7.25	6.15	6.14	6.14	4.78	4.75	4.77	2.33	2.32	2.33
T_4	7.30	7.38	7.34	6.42	6.41	6.42	5.09	5.09	5.09	2.45	2.43	2.44
T_5	7.05	7.11	7.08	5.95	5.93	5.94	4.37	4.38	4.37	1.65	1.60	1.63
T_6	7.05	7.12	7.09	6.12	6.00	6.06	4.61	4.60	4.60	1.86	1.69	1.78
T_7	7.90	8.00	7.95	6.88	6.93	6.90	5.64	5.67	5.66	3.55	3.59	3.57
T_8	7.60	7.69	7.65	6.78	6.82	6.80	5.57	5.65	5.61	3.50	3.49	3.50
T_9	8.15	8.25	8.20	7.00	7.08	7.04	5.79	5.84	5.82	3.71	3.76	3.74
T_{10}	8.55	8.64	8.60	7.70	7.77	7.73	6.49	6.54	6.52	4.41	4.46	4.43
T_{11}	8.40	8.50	8.45	7.25	7.31	7.28	6.05	6.11	6.08	3.90	3.87	3.89
T_{12}	8.55	8.64	8.60	7.75	7.83	7.79	6.55	6.60	6.58	4.53	4.56	4.54
S.Em. ±	**0.04**	**0.01**	**0.024**	**0.02**	**0.01**	**0.015**	**0.03**	**0.01**	**0.016**	**0.03**	**0.01**	**0.017**
CD (at 5%)	**0.11**	**0.04**	**0.067**	**0.07**	**0.05**	**0.042**	**0.08**	**0.03**	**0.044**	**0.09**	**0.03**	**0.046**

Interaction												
V_1T_0	7.20	7.00	7.10	5.80	6.00	5.90	4.10	4.12	4.11	1.33	1.30	1.31
V_1T_1	7.80	7.82	7.81	6.90	6.90	6.90	5.70	5.72	5.71	2.49	2.50	2.50
V_1T_2	7.90	8.00	7.95	7.09	7.00	7.05	6.70	6.76	6.73	2.90	2.86	2.88
V_1T_3	7.50	7.60	7.55	6.40	6.35	6.38	4.96	4.90	4.93	2.39	2.40	2.40
V_1T_4	7.70	7.76	7.73	6.80	6.82	6.81	5.42	5.40	5.41	2.47	2.45	2.46
V_1T_5	7.40	7.42	7.41	6.20	6.25	6.23	4.70	4.76	4.73	1.84	1.80	1.82
V_1T_6	7.40	7.44	7.42	6.50	6.36	6.43	5.00	5.10	5.05	1.90	1.92	1.91
V_1T_7	8.00	8.10	8.05	6.95	7.00	6.98	5.72	5.75	5.74	3.60	3.65	3.63
V_1T_8	7.80	7.88	7.84	7.06	7.10	7.08	5.84	5.80	5.82	3.80	3.70	3.75
V_1T_9	8.20	8.30	8.25	7.20	7.26	7.23	5.98	6.00	5.99	3.92	3.96	3.94
V_1T_{10}	8.60	8.68	8.64	7.70	7.78	7.74	6.48	6.50	6.49	4.42	4.46	4.44
V_1T_{11}	8.50	8.58	8.54	7.50	7.49	7.49	6.30	6.33	6.31	4.00	4.00	4.00
V_1T_{12}	8.60	8.70	8.65	7.80	7.90	7.85	6.60	6.65	6.62	4.55	4.60	4.58
V_2T_0	6.50	6.56	6.53	5.40	5.40	5.40	3.75	3.80	3.78	1.23	1.20	1.21
V_2T_1	7.00	7.20	7.10	6.00	6.10	6.05	5.00	5.08	5.04	2.86	2.88	2.87
V_2T_2	7.20	7.26	7.23	6.40	6.40	6.40	5.12	5.18	5.15	2.96	2.98	2.97
V_2T_3	6.90	7.00	6.95	5.90	5.92	5.91	4.60	4.60	4.60	2.26	2.25	2.26
V_2T_4	6.90	7.00	6.95	6.05	6.00	6.02	4.76	4.78	4.77	2.42	2.40	2.41
V_2T_5	6.70	6.80	6.75	5.70	5.60	5.65	4.03	4.00	4.02	1.46	1.40	1.43
V_2T_6	6.70	6.80	6.75	5.75	5.65	5.70	4.22	4.10	4.16	1.83	1.46	1.64
V_2T_7	7.80	7.90	7.85	6.80	6.86	6.83	5.56	5.60	5.58	3.50	3.52	3.51
V_2T_8	7.40	7.50	7.45	6.50	6.54	6.52	5.30	5.50	5.40	3.20	3.28	3.24
V_2T_9	8.10	8.20	8.15	6.80	6.90	6.85	5.60	5.68	5.64	3.50	3.56	3.53
V_2T_{10}	8.50	8.60	8.55	7.70	7.75	7.72	6.50	6.58	6.54	4.40	4.45	4.43
V_2T_{11}	8.30	8.42	8.36	7.10	7.12	7.11	5.80	5.90	5.85	3.80	3.75	3.77
V_2T_{12}	8.50	8.58	8.54	7.70	7.76	7.73	6.50	6.56	6.53	4.50	4.52	4.51
S.Em. ±	**0.05**	**0.02**	**0.03**	**0.03**	**0.02**	**0.02**	**0.04**	**0.01**	**0.02**	**0.04**	**0.01**	**0.02**
CD (at 5%)	**0.16**	**0.05**	**0.09**	**0.10**	**0.07**	**0.05**	**0.12**	**0.05**	**0.06**	**0.12**	**0.05**	**0.06**

4.17.2 (d) Texture on 6th and 9th day storage condition

The highest texture score (5.65) & (3.05) was recorded with Dharidar on 6th and 9th days at storage condition in 2015-2016. In the following year i.e. 2016-17 the highest flavour scored (5.68) & (3.05) with Dharidar (V_1). Pooled analysis of data 2015-16 and 2016-17 indicated that the highest texture score (5.66) & (3.05) was registered in guava variety of Dharidar on 6th and 9th days of storage conditions, respectively. Application of plant growth regulator and nutrients showed that the highest texture (6.55) & (4.53) was scored with T_{12} which was closely followed by T_{10} (4.49) & (4.41) on 6th and 9th days of storage conditions, respectively in year 2015-16. In next year, treatment T_{12} was registered highest flavour score (6.60) & (4.56) followed by T_{10} (6.54) & (4.46) and T_{11} (6.11) & (3.87) on 6th and 9th days of storage conditions. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest texture score (6.58) & (4.54) with respect to flavour was registered in T_{12} which was closely followed by T_{10} (6.52) & (4.43) and T_{11} (6.08) & (3.89) on 6th and 9th days of storage, respectively. However, lowest value of texture score was noted in control treatments in both years of experiment. Interaction study showed that the highest texture score (6.60) was registered with V_1T_{12} which was closely followed by V_2T_{12} (6.50) and V_2T_{10} (6.50) on 6th day of storage condition. On 9th day of storage condition, highest flavour score (4.55) was noted in V_1T_{12} followed by V_2T_{12} (4.50) & V_1T_{10} (4.42) on 9th day at storage, respectively, lowest texture score (4.03) was found in V_2T_5 on 6th days and & (1.33) in V_1T_0 on 9th days storage (2015-2016).In following year i.e. 2016-17 revealed that highest texture score (6.65) was obtained with V_1T_{12} followed by V_2T_{10} (6.58) & V_1T_{10} (6.50) on 6th day of storage. On 9th day of storage condition, highest flavour score (4.60) was noted in V_1T_{12} followed by V_2T_{12} (4.52), respectively, lowest texture score (3.80) & (1.20) was found in V_2T_0. Pooled analysis of data 2015-16 and 2016-17 indicated that the highest flavour score (6.62) with respect to texture was obtained in V_1T_{12} which was followed by V_2T_{10} (6.54) and V_2T_{12} (6.53) on 6th day storage conditions. On 9th day storage conditions the highest texture score (4.58) was obtained with V_1T_{12} which was closely followed by V_2T_{12} (4.51) and V_1T_{10} (4.44). However, the minimum values with

relation to texture score (3.78) & (1.21) was registered in V_2T_0 treatments on 6^{th} & 9^{th} days at storage, respectively.

4.18 Colour

It is clear from Table 4.13 indicated that fruit colour (internal & external) of varieties, plant growth regulator & nutrients was significantly influenced during 2015-16, 2016-17 and significantly affect the external & internal colour of guava cv. Chittidar and Dharidar fruits during storage were evaluated orgenoleptically at 0, 3^{rd}, 6^{th} and 9^{th} days ambient storage condition in present investigation.

4.18.1 (a) External colour at 3 day intervals up to 9 days storage

It is showed from Table 4.13 (a) that fresh guava had yellowish green colour, but with the advancement of storage period the changes in colour was observed in all the treatments during storage period.

4.18.2 (b) Internal colour at 3 day intervals up to 9 days storage

It is showed from Table 4.13 (b) that fresh guava had dark white internal colour, but with the advancement of storage period the changes in internal colour was observed in all the treatments during storage period.

14. Microbial development

Maximum incidence of *Pestalotiopsis psidii* was seen on the surface of the fruits but few colonies of *Cladosporium sp*., *Macrophomina sp.* and *Gloeosporium psidii* were also observed.

In case of percentage of fruits affected by pathogens, the minimum pathogens affected fruits were seen in Chittidar variety on 9^{th} day, T_{12} and in interaction study minimum pathogens affected fruits were seen in V_2T_{12} on 9^{th} day at storage whereas, the maximum fruits were affected under control.

Table 4.13 (a): Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on external colour at 3 day intervals up to 9 days storage

Treatments	External colour							
	0 day		3 day		6 day		9 day	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
Varieties								
V_1	YG	YG	YG	YG	DY	DY	DB+BS	DB+BS
V_2	YG	YG	YG	YG	DY	DY	DB+BS	DB+BS
Plant growth regulator and nutrients								
T_0	YG	YG	YG	YG	DY	DY	DB+BS	DB+BS
T_1	YG	YG	YG	YG	LY	LY	SY	SY
T_2	YG	YG	YG	YG	LY	LY	SY	SY
T_3	YG	YG	YG	YG	LY	LY	SW	SW
T_4	YG	YG	YG	YG	LY	LY	SY	SY
T_5	YG	YG	YG	YG	DY	DY	DB	DB
T_6	YG	YG	YG	YG	DY	DY	DB	DB
T_7	YG	YG	YG	YG	YG	YG	LY	LY
T_8	YG	YG	YG	YG	LY	LY	SY	SY
T_9	YG	YG	YG	YG	YG	YG	DY	DY
T_{10}	YG	YG	YG	YG	YG	YG	LY	LY
T_{11}	YG	YG	YG	YG	YG	YG	DY	DY
T_{12}	YG	YG	YG	YG	YG	YG	LY	LY
Interaction								
V_1T_0	YG	YG	YG	YG	DY	DY	DB+BS	DB+BS
V_1T_1	YG	YG	YG	YG	LY	LY	SY	SY
V_1T_2	YG	YG	YG	YG	LY	LY	SY	SY
V_1T_3	YG	YG	YG	YG	LY	LY	SW	SW

V_1T_4	YG	YG	YG	YG	LY	LY	SY	SY
V_1T_5	YG	YG	YG	YG	DY	DY	DB	DB
V_1T_6	YG	YG	YG	YG	DY	DY	DB	DB
V_1T_7	YG	YG	YG	YG	YG	YG	LY	LY
V_1T_8	YG	YG	YG	YG	LY	LY	SY	SY
V_1T_9	YG	YG	YG	YG	YG	YG	DY	DY
V_1T_{10}	YG	YG	YG	YG	YG	YG	LY	LY
V_1T_{11}	YG	YG	YG	YG	YG	YG	DY	DY
V_1T_{12}	YG	YG	YG	YG	YG	YG	LY	LY
V_2T_0	YG	YG	YG	YG	LY	DY	DB+BS	DB+BS
V_2T_1	YG	YG	YG	YG	LY	LY	SY	SY
V_2T_2	YG	YG	YG	YG	LY	LY	SY	SY
V_2T_3	YG	YG	YG	YG	LY	LY	SW	SW
V_2T_4	YG	YG	YG	YG	LY	LY	SY	SY
V_2T_5	YG	YG	YG	YG	DY	DY	DB	DB
V_2T_6	YG	YG	YG	YG	DY	DY	DB	DB
V_2T_7	YG	YG	YG	YG	YG	YG	LY	LY
V_2T_8	YG	YG	YG	YG	LY	LY	SY	SY
V_2T_9	YG	YG	YG	YG	YG	YG	DY	DY
V_2T_{10}	YG	YG	YG	YG	YG	YG	LY	LY
V_2T_{11}	YG	YG	YG	YG	YG	YG	DY	DY
V_2T_{12}	YG	YG	YG	YG	YG	YG	LY	LY

Symbol: Greenish (G) Dark yellow (DY) Creamy white (CW) Yellowish green (YG) Broun spot (BS) Dull white (DW) Light yellowish (LY) Straw yellow (SY) Straw white (SW) Medium yellow (MY) Dark brown (DB) Brownish white (BW)

Table 4.13 (b): Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on internal colour at 3 day intervals up to 9 days storage

Treatments	Internal colour							
	0 day		3 day		6 day		9 day	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
Varieties								
V_1	DW	DW	CW	CW	SW	SW	BW	BW
V_2	DW	DW	CW	CW	SW	SW	BW	BW
Plant growth regulator and nutrients								
T_0	DW	DW	SW	SW	SW+BW	SW+BW	BW	BW
T_1	DW	DW	DW	DW	SW	SW	BW	BW
T_2	DW	DW	DW	DW	SW	SW	BW	BW
T_3	DW	DW	DW	DW	CW	CW	BW	BW
T_4	DW	DW	DW	DW	CW	CW	BW	BW
T_5	DW	DW	DW	DW	SW	SW	BW	BW
T_6	DW	DW	DW	DW	SW	SW	BW	BW
T_7	DW	DW	DW	DW	CW	CW	SW	SW
T_8	DW	DW	DW	DW	CW	CW	BW	BW
T_9	DW	DW	DW	DW	SW	SW	SW	SW
T_{10}	DW	DW	DW	DW	SW	SW	SW	SW
T_{11}	DW	DW	DW	DW	SW	SW	SW	SW
T_{12}	DW	DW	DW	DW	SW	SW	SW	SW
Interaction								
V_1T_0	DW	DW	DW	DW	SW+BW	SW+BW	BW	BW

V_1T_1	DW	DW	DW	DW	SW	SW	BW	BW
V_1T_2	DW	DW	DW	DW	SW	SW	BW	BW
V_1T_3	DW	DW	DW	DW	CW	CW	BW	BW
V_1T_4	DW	DW	DW	DW	CW	CW	BW	BW
V_1T_5	DW	DW	DW	DW	SW	SW	BW	BW
V_1T_6	DW	DW	DW	DW	SW	SW	BW	BW
V_1T_7	DW	DW	DW	DW	CW	CW	SW	SW
V_1T_8	DW	DW	DW	DW	CW	CW	BW	BW
V_1T_9	DW	DW	DW	DW	SW	SW	SW	SW
V_1T_{10}	DW	DW	DW	DW	SW	SW	SW	SW
V_1T_{11}	DW	DW	DW	DW	SW	SW	SW	SW
V_1T_{12}	DW	DW	DW	DW	SW	SW	SW	SW
V_2T_0	DW	DW	DW	DW	SW+BW	SW+BW	BW	BW
V_2T_1	DW	DW	DW	DW	SW	SW	BW	BW
V_2T_2	DW	DW	DW	DW	SW	SW	BW	BW
V_2T_3	DW	DW	DW	DW	CW	CW	BW	BW
V_2T_4	DW	DW	DW	DW	CW	CW	BW	BW
V_2T_5	DW	DW	DW	DW	SW	SW	BW	BW
V_2T_6	DW	DW	DW	DW	SW	SW	BW	BW
V_2T_7	DW	DW	DW	DW	CW	CW	SW	SW
V_2T_8	DW	DW	DW	DW	CW	CW	BW	BW
V_2T_9	DW	DW	DW	DW	SW	SW	SW	SW
V_2T_{10}	DW	DW	DW	DW	SW	SW	SW	SW
V_2T_{11}	DW	DW	DW	DW	SW	SW	SW	SW
V_2T_{12}	DW	DW	DW	DW	SW	SW	SW	SW

Symbol: Creamy white (CW) Dull white (DW) Straw white (SW) Brownish white (BW)

Table 4.14: Economics of the different treatments (per ha.) during 2015-16

Treat.	Total cost	Marketable yield (Kg)				Gross return during storage period (□)				Net return during storage period (□)		
		0 day	3 day	6 day	9 day	0 day	3 day	6 day	9 day	0 day	3 day	6 day
V_1T_0	50000	16680	16680	5903.05	1487.86	250200	250200	59031	8927	200200	200200	9030.52
V_1T_1	53336	16680	16680	13450.75	6793.76	250200	250200	134508	40763	196864	196864	81171.52
V_1T_2	56672	16680	16680	14201.35	7662.79	250200	250200	142014	45977	193528	193528	85341.52
V_1T_3	53336	16680	16680	14981.98	8319.98	250200	250200	149820	49920	196864	196864	96483.76
V_1T_4	56672	16680	16680	16079.52	9414.19	250200	250200	160795	56485	193528	193528	104123.20
V_1T_5	54170	16680	16680	9854.54	3002.40	250200	250200	98545	18014	196030	196030	44375.44
V_1T_6	58340	16680	16680	10061.38	3129.17	250200	250200	100614	18775	191860	191860	42273.76
V_1T_7	63344	16680	16680	16680.00	11729.38	250200	250200	166800	70376	186856	186856	103456
V_1T_8	65012	16680	16680	14474.90	7979.71	250200	250200	144749	47878	185188	185188	79737.04
V_1T_9	60842	16680	16680	16680.00	10161.46	250200	250200	166800	60969	189358	189358	105958
V_1T_{10}	68348	16680	16680	16680.00	10781.95	250200	250200	166800	64692	181852	181852	98452
V_1T_{11}	64178	16680	16680	16680.00	10311.58	250200	250200	166800	61869	186022	186022	102622
V_1T_{12}	71684	16680	16680	16680.00	12104.68	250200	250200	166800	72628	178516	178516	95116
V_2T_0	50000	16680	16680	6278.35	1624.63	250200	250200	62784	9748	200200	200200	12783.52
V_2T_1	53336	16680	16680	13654.25	7000.60	250200	250200	136542	42004	196864	196864	83206.48
V_2T_2	56672	16680	16680	14695.08	7506.00	250200	250200	146951	45036	193528	193528	90278.80
V_2T_3	53336	16680	16680	15073.72	8376.70	250200	250200	150737	50260	196864	196864	97401.16
V_2T_4	56672	16680	16680	16169.59	9514.27	250200	250200	161696	57086	193528	193528	105023.90
V_2T_5	54170	16680	16680	9781.15	3120.83	250200	250200	97812	18725	196030	196030	43641.52
V_2T_6	58340	16680	16680	9892.91	3242.59	250200	250200	98929	19456	191860	191860	40589.08
V_2T_7	63344	16680	16680	16680.00	12223.10	250200	250200	166800	73339	186856	186856	103456
V_2T_8	65012	16680	16680	14868.55	8096.47	250200	250200	148686	48579	185188	185188	83673.52
V_2T_9	60842	16680	16680	16680.00	9781.15	250200	250200	166800	58687	189358	189358	105958
V_2T_{10}	68348	16680	16680	16680.00	11582.59	250200	250200	166800	69496	181852	181852	98452
V_2T_{11}	64178	16680	16680	16680.00	10631.83	250200	250200	166800	63791	186022	186022	102622
V_2T_{12}	71684	16680	16680	16680.00	12233.11	250200	250200	166800	73399	178516	178516	95116

Table 4.15: Economics of the different treatments (per ha.) during 2016-17

Treat.	Total cost	Marketable yield (Kg)				Gross return during storage period (□)				Net return during storage period (□)		
		0 day	3 day	6 day	9 day	0 day	3 day	6 day	9 day	0 day	3 day	6 day
V_1T_0	52000	17514	17514	5811.15	1737.39	262710	262710	58111	10424	210710	210710	6111.452
V_1T_1	55336	17514	17514	13643.41	6585.26	262710	262710	136434	39512	207374	207374	81098.06
V_1T_2	58672	17514	17514	14480.58	7257.80	262710	262710	144806	43547	204038	204038	86133.75
V_1T_3	55336	17514	17514	15349.27	8191.30	262710	262710	153493	49148	207374	207374	98156.70
V_1T_4	58672	17514	17514	16578.75	9391.01	262710	262710	165788	56346	204038	204038	107115.50
V_1T_5	56170	17514	17514	9986.48	2858.28	262710	262710	99865	17150	206540	206540	43694.83
V_1T_6	60340	17514	17514	10000.49	2959.87	262710	262710	100005	17759	202370	202370	39664.94
V_1T_7	65344	17514	17514	17514.00	11944.55	262710	262710	175140	71667	197366	197366	109796
V_1T_8	67012	17514	17514	14296.68	8056.44	262710	262710	142967	48339	195698	195698	75954.78
V_1T_9	62842	17514	17514	17514.00	10294.73	262710	262710	175140	61768	199868	199868	112298
V_1T_{10}	70348	17514	17514	17514.00	11180.94	262710	262710	175140	67086	192362	192362	104792
V_1T_{11}	66178	17514	17514	17514.00	10433.09	262710	262710	175140	62599	196532	196532	108962
V_1T_{12}	73684	17514	17514	17514.00	12314.09	262710	262710	175140	73885	189026	189026	101456
V_2T_0	52000	17514	17514	6133.40	1369.59	262710	262710	61334	8218	210710	210710	9334.028
V_2T_1	55336	17514	17514	14270.41	7170.23	262710	262710	142704	43021	207374	207374	87368.07
V_2T_2	58672	17514	17514	15391.30	7285.82	262710	262710	153913	43715	204038	204038	95241.03
V_2T_3	55336	17514	17514	15783.62	8723.72	262710	262710	157836	52342	207374	207374	102500.20
V_2T_4	58672	17514	17514	16992.08	9888.40	262710	262710	169921	59330	204038	204038	111248.80
V_2T_5	56170	17514	17514	10270.21	3059.70	262710	262710	102702	18358	206540	206540	46532.10
V_2T_6	60340	17514	17514	10406.82	3078.96	262710	262710	104068	18474	202370	202370	43728.19
V_2T_7	65344	17514	17514	17514.00	12802.73	262710	262710	175140	76816	197366	197366	109796
V_2T_8	67012	17514	17514	15485.88	7993.39	262710	262710	154859	47960	195698	195698	87846.79
V_2T_9	62842	17514	17514	17514.00	10357.78	262710	262710	175140	62147	199868	199868	112298
V_2T_{10}	70348	17514	17514	17514.00	11963.81	262710	262710	175140	71783	192362	192362	104792
V_2T_{11}	66178	17514	17514	17514.00	10751.84	262710	262710	175140	64511	196532	196532	108962
V_2T_{12}	73684	17514	17514	17514.00	12657.37	262710	262710	175140	75944	189026	189026	101456

*On 9th day after storage the decay loss become more in almost treatment and the net income comes in negative way. Cost of fruits at 0, 3, 6, & 9th days of storage 15/-, 15/-, 10/-, & 6/- per Kg, respectively.

4. Economic analysis

A critical examination of data presented in Table 4.14 & 4.15 and revealed that varieties, plant growth regulator & nutrients was significantly influenced the net returns during 2015-16 and 2016-17. In the year of 2015-16 maximum net returns (105958 ha^{-1}) were recorded in V_1T_9 and V_2T_9 which was followed by V_1T_4 (104123.20) on 6th day of storage during 2015-16. In the following year i.e. 2016-17, the maximum net return (112298 ha^{-1}) were recorded in V_1T_9 and V_2T_9 which was followed by V_1T_7 V_2T_7 (109796) on 6th day of storage during 2016-17.

Chapter-V
DISCUSSION

Result of the experiment entitled **"Effect of Pre-harvest Spray of GA_3, Calcium Nitrate and Potassium Sulphate on Post-harvest Behaviour of Guava (*Psidium guajava* L.) Fruits of Cultivars Dharidar and Chittidar"** presented in the preceding chapter revealed that varieties (Dharidar and Chittidar), plant growth regulator (GA_3) & nutrients $Ca(NO_3)_2$ & K_2SO_4) significantly influenced the various post harvest parameters *viz*., physiological loss in weight (PLW), decay loss, fruit size (fruit length & diameter), specific gravity, marketable fruits, marketable fruits retained over control, TSS, acidity, reducing sugars, non-reducing sugars and total sugars, pectin content sensory score, colour and microbial population of pathogens of guava fruits at 3 day intervals up to 9^{th} days during the ambient storage condition. The salient features of the results obtained are being discussed in this chapter.

An attempt has been made to establish the relationship amongst different post harvest parameters as affected by the different treatments under the present study. The important findings which have emerged from this study have been discussed in brief to derive valid conclusions with the help of existing literature related on the subjects.

Data recorded for the various post-harvest parameters of guava revealed several points of interest which can be discussed in conjunction with the findings of other workers. It is realized that the assessment of experimental treatments by such supplementary data has been reasonably justified.

5.1 Physiological loss in weight

Physiological loss in weight during storage is characterized by reduction in fruit weight by the way of loss of moisture through evaporation and/or transpiration. It is the most important parameter because it governs the post-harvest quality of the guava fruits. Any loss in weight of fruit is likely to reduce the quality of product drastically. Therefore, one of the main objectives of any pre and post-harvest treatment should be to reduce the physiological

loss in weight. It is evident from the present study that loss in weight was significantly affected by different treatments throughout the storage period.

A perusal of data in Table 4.1 showed that per cent PLW was influenced significantly by varieties, plant growth regulator & nutrients and their interactions under the ambient storage conditions at 3 day intervals up to 9^{th} days at storage. The weight loss increased gradually and progressively with advancement in storage period. The minimum loss in physiological weight (4.68, 7.44 and 12.16%) was recorded on 3^{rd}, 6^{th} and 9^{th} days, respectively in guava variety of Chittidar fruits stored at ambient condition. Plant growth regulator and nutrients (GA_3, calcium nitrate and potassium sulphate) had significantly increased the loss in physiological weight as the storage period advanced irrespective of any treatments. Treatment T_{12} (GA_3 @100ppm + calcium nitrate @ 2% + potassium sulphate @ 2%) was recorded the minimum loss in physiological weight (2.97, 5.20 & 10.04%) followed by T_7 (3.70, 5.46 & 10.67%) and T_{10} (3.89, 5.73 & 11.01%) on 3^{rd}, 6^{th} and 9^{th} days at storage, respectively. However, maximum loss in physiological weight was recorded in control treatment. As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar varieties of guava fruits revealed that significant variation was noticed for physiological loss in weight, treatment, V_2T_{12} was recorded minimum loss in physiological weight (2.96, 5.09 & 9.69%) which was followed by V_1T_{12} (2.98, 5.31 and 10.12%) and V_2T_7 (3.56, 5.37 & 10.16%) on 3^{rd}, 6^{rd} & 9^{th} days at storage, respectively. However, maximum losses in physiological weight (8.50, 15.69 and 24.06%) were recorded in V_1T_0. Higher concentration, $Ca(NO_3)_2$ showed lowest weight loss this might be due to role of calcium on altering the membrane permeability of cell wall and thereby limiting the rate of respiration (Bengerth, 1979). Prolongation of fruit life due to growth regulators is probably due to effectiveness of these chemical in retardation of ripening and senescence and reduction in weight loss (Huang, 1974). Effectiveness of GA_3 in maintaining fruit firmness may be due to the reason that might reduce various physiological activities related with softening of fruits (Rees 1975). Many workers, Singh (1998), Aly and Ismail (2000), Mahajan *et al*. (2011) in guava, Jakhar and Pathak (2016) in

mango, Singh *et al*. (2014) in aonla also reported calcium nitrate and GA_3 had effectively reduce the weight loss during storage . Lal *et al*. (2015) reported that PLW (%) in stored fruits of Kinnow mandarin were significantly decreased by spray of plant bio- regulators & micronutrients as compared to control.

5.2 **Decay loss**

Pooled analysis of the data 2015-16 and 2016-17 revealed that minimum decay loss percentage (15.38 & 52.28%) on 6^{th} and 9^{th} days at storage, respectively in fruits of Chittidar guava.

Plant growth regulator and nutrients (GA_3, calcium nitrate and potassium sulphate) had significantly minimized the decay loss of guava fruits in both years of experiment. Pooled analysis of the data of 2015-16 and 2016-17 revealed that minimum decay loss percentage (27.88%) was recorded in T_{12} followed by T_7 (28.77%) and T_{10} (33.44%) on 9^{th} day at storage, respectively. The highest decay loss was recorded in control treatments in both years of study. As regards to interaction study revealed that significant variation was noticed for decay loss on 6^{th} and 9^{th} days of storage of guava fruits in both years. Pooled analysis of the data 2015-16 and 2016-17 revealed that minimum decay loss percentage (26.81%) in V_2T_7 (Chittidar with GA_3 @ 100 ppm + calcium nitrate @ 2%) which was followed by 27.19% in V_2T_{12} (Chittidar with GA_3 @100 ppm + calcium nitrate @ 2%, potassium sulphate @ 2%) and V_1T_{12} (28.56%). However, the maximum decayed fruit (9 1.22%) was obtained in V_2T_{12}. Earlier, Gupta *et al*. (1984) reported that calcium compound significantly thickened the middle lamella of fruit cells owing to increased depositions of calcium pectate and thereby maintained the cell wall, which inhibits the penetration and spread of pathogens in fruits. The lower decay loss percentage in GA_3 treated fruits could be due to anti-senescent and antiperspirant properties of the gibberellins which prevent the cellular disintegration with enhancing resistant ability in the fruits Rokaya *et al*. (2016). Similar results were reported by Amir *et al*. (2003) in Kinnow mandarin, Brahmachari and Rani (2005) in guava, Sen *et al*. (2012) in Satsuma mandarin and Bhat, *et al.* (2012) in pear cv. Bartlett.

5.3 Fruit size (length and diameter)

The fruit size (length and diameter) decreased with the increase in storage period as given in Table 4.3 and 4.4. However, the treated fruits maintained higher values of fruit size as compared to control. The reduction in fruit size during storage period may be due to shrinking of fruits caused by transpiration. Application of chemicals might have decreased the rate of transpiration and physiological loss in weight resulting in retention of better size fruits during storage.

At the end of the storage the minimum reduction in fruit size i.e. length in fruit of cv. Chittidar & diameter was recorded in fruits of Dharidar. Application of plant growth regulator (GA_3) and nutrients alone & in conjunction had influenced the length and diameter of the fruits. The maximum fruit length (6.27 cm) and maximum diameter (6.30 cm) was recorded in T_{12} (GA_3 @ 100ppm + calcium nitrate @ 2% + potassium sulphate @ 2%). It might be due to the ant senescent action of GA_3 and cell degradation was prevented by $Ca(NO_3)_2$ which in turn facilitated the reduced moisture loss and lesser respiratory gas exchange, hence delay in ripening and lower the shrinkage percentage. The effect of higher concentration of calcium compound and GA_3 on guava fruits was also supported by Lal *et al*. (2011) in Apricot cv. Harcot, Bisen *et al*. (2014) in guava, Kirmani *et al*. (2013) in Plum and Manivannan *et al*. (2015) in guava cv. L-49.

5.4 Specific gravity

Specific gravity of guava varieties was significantly influenced by plant growth regulator & nutrients during both years of experiment. Chittidar variety recorded the maximum specific gravity (0.91) on 6^{th} day of storage. Specific gravity on 9^{th} day of guava fruits storage was found non-significant. As regards to gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) alone and in combination treatment T_{12} (GA_3 @100 ppm + calcium nitrate @ 2% + potassium sulphate @ 2%) was recorded maximum specific gravity (0.97) and (0.95) on 6^{th} day and 9^{th} day at storage condition which was followed by T_7 (0.95) & (0.93) on 6^{th} day and 9^{th} day at storage condition, respectively. The gradual decrease in specific gravity in both years

of calcium treated fruits could possibly be due to slow reduction in weight and volume of the fruit because of the retarding effect of calcium on ripening process, such findings also been reported by Chundawat *et al* . (1978), Singh (1980), kher *et al*. (2005) in guava, Kazemi *et al.* (2011) in Kiwifruit, Bisen, *et al.* (2014) in guava and Desai *et al*. (2017) in sapota.

5.5 Marketable fruits

It is clear from Table 4.6 that among two variety of guava, Dharidar variety of guava had obtained maximum marketable fruits (47.72%) on 9^{th} day at storage condition. Application of plant growth regulator and nutrients revealed that significant variations were noticed for marketable fruits percentage in two year experiments. Maximum marketable fruits (72.13%) were obtained in T_{12} which was the statistically superior compare to other treatments which was followed by T_7 (71.23%). As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar varieties of guava fruits, the maximum marketable fruits (73.19%) were obtained under V_2T_7 followed by V_2T_{12} (72.81%) and V_1T_{12} (71.44%). However, the minimum marketable fruits (8.78%) were obtained in V_2T_0. The increase in fruit marketability might be due to decrease in production of ethylene which is responsible for the fast ripening of fruits, improved fruit colour development and appearance (Cheour *et al*. ,1990). GA_3 on fruits and plants acts as an anti-senescence agent (Ahmed *et al.* 2001).Singh (1998) and Singh *et al.* (2007) found that calcium treated guava fruits rated higher score and optimum marketable quality for longer period. Almost similar results were also obtained by Goutam *et al*. (2010) in guava, Chouhan *et al.* (2015) in Mango cv. Dashehari and Vishwakarma *et al.* (2017) in mango cv. Amrapali.

5.6 Marketable fruits retained over control

At end storage period marketable fruits retained over the control had significantly influenced with pre-harvest application of plant growth regulator and nutrients alone and in combination. Among two variety of guava, Dharidar variety of guava was obtained maximum (38.94%) marketable fruits retained over control.

It has been observed that the application of different alone and combined treatments of plant growth regulator and nutrients (GA_3, calcium nitrate and potassium sulphate) proved beneficial effect in obtaining the maximum percentage of marketable fruits retained over the control. Maximum marketable fruits retained over control (63.03%) were recorded in T_{12} treatment which was followed by T_7 (62.13%) and T_{10} (57.46%). As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar varieties of guava fruits maximum marketable fruits retained over control (64.41%) were noted in V_2T_7 which was followed by V_2T_{12} (64.03%) and V_1T_{12} (62.03%). However the minimum marketable fruits retained over control (7.74%) with V_1T_5. Retained marketability fruit over control might be due to decrease in production of ethylene which is responsible for the fast ripening of fruits, improved fruit colour development and appearance (Cheour *et al*. ,1990). Singh (1998) and Singh *et al*. (2007) also found that calcium treated guava fruits rated higher score and optimum marketable quality for longer period. Almost similar results were also obtained by Goutam *et al*. (2010) in guava and Chouhan *et al*. (2015) in Mango cv. Dashehari.

5.7 Total soluble solids

In all treatments, total soluble solid contents had increased slowly up to 3rd day at storage in both years of experiment, thereafter declined slowly up to 9th day at storage. Pooled analysis of data 2015-16 and 2016-17 revealed that fruits of variety Chittidar observed maximum TSS (11.93 & 10.38^{o}B) on 6th and 9th days at storage condition. Application of plant growth regulator and nutrients revealed that significant variations were noticed for TSS right from 0 day to 9th days at storage condition. Pooled analysis of data 2015-16 and 2016-17 indicated that highest TSS (12.51 and 11.22 ^{o}B) was found in T_{12} which was followed by T_{10} (12.25 & 11.08 ^{o}B) and T_8 (12.08 & 10.84 ^{o}B) on 6th and 9th days at ambient storage condition, respectively. As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar varieties of guava fruits revealed that highest TSS (12.77 ^{o}B) and (11.35 ^{o}B) was found in V_2T_{12} followed by V_2T_{10} (12.46 & 11.34 ^{o}B) V_2T_8 (12.38 & 11.17 ^{o}B) on 6th and 9th

days at ambient storage condition, respectively. Potassium sulphate (K_2SO_4) and {$Ca(NO_3)_2$} treated fruits found highest TSS as compared to control. In control a sharp decline was noticed in different storage intervals and shelf-life indicating rapid metabolic breakdown in these fruits. The TSS content of guava fruits significantly increased with storage period, reached its peak, and then declined during the storage at ambient temperature in both years of study. The initial increase in TSS content might be due to the breakdown of starch and polysaccharides into simple sugars and organic acid during the subsequent storage, but later on, the decline in TSS content might be due their utilization in evapo-transpiration, respiration process, and other biochemical activities (Koksal *et al*., 1994). Higher TSS level was retained by K_2SO_4 and $Ca(NO_3)_2$ treated fruits during storage may due to role of K_2SO_4 and $Ca(NO_3)_2$ in maintaining the lowest metabolic activity during storage of fruits. Similarly, earlier reports have revealed that the pre harvest spray of $CaCl_2$ and K_2SO_4 improve the TSS content of mango fruits (Burondkar *et al*., 2009; Karemera and Habimana, 2014; Jakhar and Pathak, 2016) in mango and Mishra *et al.* (2017) also reported in guava fruits.

The effect of GA_3 application on different fruit quality attributes was superior over control but comparatively lesser than the calcium treatments may be attributed to the fact that GA_3 application is more effective when applied during early stages of fruit development. As the fruit advance toward maturity the influence of this hormone on fruit development fades away (Rokaya *et al*. 2016).

5.8 Acidity

It is clear from Table 4.9 in all the treatments, acidity increased slowly up to 3rd day of storage, thereafter declined slowly under the present two years experiment of 2015-16 and 2016-17. Pooled analysis of data 2015-16 and 2016-17 revealed that minimum pulp acidity (0.49%) was recorded in fruits of Chittidar variety of guava. There was non-significant observation recorded in 9th day of storage. Pooled analysis of data 2015-16 and 2016-17 indicated that lowest acidity (0.46%) was found in T_8 and $T_{12,}$ with which equal performance on 6th day of storage. At 9th day of storage the minimum acidity (0.34%) was recorded with T_{12} which was followed by T_{10} (0.35%) and T_8

(0.36%). Interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) alone and in combination with Dharidar & Chittidar varieties of guava fruits revealed that non-significant variations was found in respect to acidity right from initial day to 9th days of ambient storage condition. The decreased acids during ripening and storage may be attributed to an increase in malic enzymes and pyruvate dicarboxylation reaction during the climacteric period (Rhodes *et al.,* 1968). Calcium nitrate (2.0%) reduced the acidity in guava fruits during storage (Singh, *et al.* 2004). The results are in agreement with the earlier findings of Singh *et al*. (2004) in aonla, Singh *et al*. (2014) in aonla, Mahajan *et al*. (2011) in guava Shukla *et al*. (2011) in aonla cv. Banarasi and Lal *et al*. (2015) in Kinnow mandarin.

5.9 Sugars (Reducing sugar, non reducing sugar and total sugar content)

It is clear from pooled data presented in Table 4.10 (a, b & c) that maximum reducing sugars (3.91%) was found in Dharidar, maximum non-reducing sugars (3.45%) was recorded in Chittidar, however maximum total sugars (7.25%) was recorded in Dharidar on 9th day at storage period.

Application of plant growth regulator (GA_3) and nutrients $Ca(NO_3)_2$ and K_2SO_4 revealed treatment T_{12} was recorded the maximum reducing sugars (4.97%), non-reducing sugars (4.60%) and total sugars (9.57%) on 9th day at storage followed by T_{10} (4.74%), (4.42%) & (9.16%) and T_8 (4.54%), (4.04%) & (8.58%), respectively. Interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) alone and in combination with Dharidar & Chittidar varieties of guava fruits revealed that maximum reducing sugars (5.81%) was recorded in V_IT_{12} which was followed by V_2T_{12} (5.73%) and V_2T_{10} (5.43%) on 6th day of storage respectively. At 9th day of storage maximum reducing sugars (5.16%) was recorded in V_IT_{12} which was followed by V_2T_{12} (4.79%) and V_1T_{10} (4.75%), respectively. Maximum non-reducing sugars (5.01%) was recorded in V_2T_{12} & V_2T_{10} which had equal performance as regards to non-reducing sugar content followed by V_2T_8 (4.81%) and V_1T_{12} (4.68%) on 6th day at storage, respectively. At 9th day of storage the maximum non-reducing sugars (4.75%) was recorded with V_2T_{12} which was followed by V_2T_{10} (4.49%) and V_1T_{12} (4.44%), respectively.

Maximum total sugars (10.81%) was recorded in V_2T_{12} which was followed by V_1T_{12} (10.54%) and V_2T_{10} (10.52%) on 6th day of storage, respectively. While on 9th day storage conditions the maximum total sugars (9.61%) was recorded in V_1T_{12} followed by V_2T_{12} (9.54%) and V_2T_{10} (9.23%), respectively. The initial increase in sugars content of fruits during storage might be because of an increase in reducing sugars and non-reducing sugars resulting from conversion of starch into simple sugars and later on reduction in sugar content mainly due to its utilization in respiration process (Banday, 1996). Manivannan *et al.* (2015) reported that the pre harvest application, 1 per cent K_2SO_4 recorded significantly for both the total sugars and reducing sugars as compared to control. The findings of Singh (1980) also support the contention that sugars initially increased and subsequently decreased during storage owing to calcium treatment. $Ca(NO_3)_2$ and GA_3 combination apply at pre harvest than also increase total sugars, reducing sugars and non-reducing sugars up to 2 days at storage period followed by a decrease thereafter. The increase in sugars due to calcium treatment was also reported by Bhat *et al*. (1997) in cherry, Jayachandra *et al.* (2005) in guava. Jakhar and Pathak (2016) reported that significantly highest sugars content was recorded in treatment of 2% $CaCl_2$ +1% K_2SO_4 in both years. Similar results have also been obtained by Bisen *et al*. (2014) in guava, Karemera and Habimana (2014) in mango, Lal *et al*. (2015) in Kinnow mandarin and Mishra, *et al*. (2017) in guava cv. L-49.

5.10 Pectin

On 6th days of storage in both years of experiment i.e. 2015-16 and 2016-17 found that non significant variations. However, on 9th day of storage pooled data showed that maximum pectin (0.57%) was noted with fruits of Dharidar.

Application of plant growth regulator and nutrients showed that the maximum pectin content (1.06 & 0.92%) was recorded with T_{12} which was followed by T_{10} (1.02 & 0.88) and T_7 (0.99 & 0.83%) on 6th and 9th days at storage conditions, respectively. However, non-significant variations were found under interaction study. The initial mean pectin content of the fruits (0.90%) decreased to (0.56%) by 9th day of storage (Table 4.11). The pectin

content is related to the firmness of the fruit, where a decreasing firmness or softening of the fruit causes a very marked decreased in protopectin and an increase in soluble pectin (Hansen, 1966). Increase in external applied calcium concentration resulted in increased deposition and uptake of calcium by fruits and thus maintain higher contents of pectin during storage than control. Application of calcium salts might have minimized the activity of pectin degrading enzymes in guava fruits during storage (Singh and Chouhan 1981; Jayachandran *et al.* 2005). These results also are in line with the accordance of Kumar, *et al*. (2012) in guava, Chouhan *et al*. (2014) in Dasheheri mango, Rajput *et al*. (2008) in guava and Deepthi *et al*. (2016) in guava.

5.11 Sensory score

Sensory score is the overall impact of the chemicals and storage period on physical and chemical parameters of guava fruits. The fresh harvested fruits scored maximum rating. The Sensory rating of guava fruits decreased gradually in treated fruits as compared to untreated ones during storage.

5.11.1 Appearance

Fruit appearance is an important quality parameter because it attracts the consumer visually and thus influences the market price. The treatment with plant growth regulator and nutrients and storage period had pronounced effect on appearance of fruit. The different treatments affected appearance of the fruit significantly (Table 4.12 a). The treated fruits showed maximum rating of appearance of guava up to 3rd day of storage then after decreases gradually up to 9th days of storage period.

At the end of storage period the highest score (2.91) with respect to appearance was registered in fruits of guava variety of Dharidar. Application of plant growth regulator and nutrients showed that highest score (4.72) with respect to appearance was registered in T_{12} which was closely followed by T_{11} (4.43), lowest appearance (1.07) was scored in T_0, respectively. Interaction study showed that the highest score (4.74) was registered in V_1T_{12} which was followed by V_2T_{12} (4.71) and V_2T_{11} (4.53), respectively. Delayed loss in skin greenness in $Ca(NO_3)_2$ treated fruits, organoleptic score for fruit appearance

and colour were higher because they were free from shrivelling and dark spots. Prolongation of fruit life due to growth regulators is probably due to effectiveness of these chemicals in retardation of ripening and senescence and reduction in weight loss (Haung, 1974). These results are in agreement with the findings of Chahal and Bal (2003), Hayat *et al*. (2003) in apple cv. Banky and Jawandha *et al.* (2008) in Umran ber.

5.11.2 Taste

Fruit taste is the most important parameter from consumer's side and taste also influences the market price of the fruits. At the end of storage period the highest score (3.50) with respect to taste was registered in guava variety of Chittidar on 9^{th} day of storage conditions. Application of plant growth regulator (GA_3) and nutrients $Ca(NO_3)_2$ and K_2SO_4) showed that the highest taste score (5.33) was obtained with treatment T_{12} followed by T_{10} (5.2 8) and T_{11} (4.81) on 9^{th} day at storage period, respectively. Interaction study showed that at the end of storage i.e. on 9^{th} day of storage conditions the highest taste score (5.36) was obtained with V_2T_{12} which was closely followed by V_2T_{10} (5.33) and V_1T_{12} (5.31), respectively. Higher rating could be mainly due to proper blend of total soluble solids, sugar and acid content of fruits under the application of these treatments as observed in the present investigation. Singh *et al.* (2004) who noted that TSS, sugars and acid content enhanced by application of potassium and calcium in guava fruits. These finding are more or less similar to those observed by Singh *et al.* (2014) in aonla.

5.11.3 Flavour

At the end of storage period the highest flavour score (3.77) was judged in guava variety of Dharidar. Application of plant growth regulator and nutrients the highest flavour score (4.73) with respect to flavour was registered in T_{12} which was closely followed by T_{11} (4.55) and T_{10} (4.39) respectively. Interaction study showed that the highest flavour score (4.79) was obtained with V_1T_{12} which was closely followed by V_1T_{10} (4.69) and V_2T_{12} (4.67), respectively. This improvement of palatability rating of guava fruits during storage might be due to the build up of sugars and acids as a result of

hydrolysis of starch and other complex molecules leading to development of flavour in fruits. Singh (1988), Singh *et al.* (2007) and Mandal *et al.* (2010) in guava also found that calcium nitrate treated guava fruits rated higher score and optimum marketable quality for longer period.

5.11.4 Texture

It is clear from Table 4.12 (d) that at the end of storage period the highest texture score (3.05) was judged in guava variety of Dharidar. Application of plant growth regulator (GA_3) and nutrients $Ca(NO_3)_2$ and K_2SO_4) showed the highest texture score (4.54) with respect to flavour was registered in T_{12} which was closely followed by T_{10} (4.43) and T_{11} (3.89) on 9th day at storage. Interaction study revealed that highest texture score (4.58) was obtained with V_1T_{12} which was closely followed by V_2T_{12} (4.51) and V_1T_{10} (4.44) on 9th day at storage. Increase in calcium content of the fruit has been associated with reduced softening (Haggag, 1987). Similar results were also reported by Chahal and Bal (2003) in ber fruits and Jawandha *et al.* (2008) in Umran ber fruits.

5.12 Colour

The details regarding the change in colour of guava (external and internal) as affected by various treatment and storage time. Fruits during storage were evaluated orgenoleptically at 0, 3rd, 6th and 9th days at storage.

External colour

External fruit colour is also an important quality parameter because it attracts the eyes of consumer and thus influences the market price. The treatment with chemical had pronounced effect on change in colour of fruits.

It is revealed from (Table 4.13 a) that fresh guava had yellowish green colour, but with the advancement of storage period the changes in colour was observed in all the treatments during storage period. The delay in coloration seems probably due to delayed ripening (Looney, 1972). Colour development in fruits treated with higher concentration of calcium nitrate was delayed. Similar results have been reported in mango and pear by Tirimazi and Wells (1981). Colour development in pear fruits increased with advancing period of storage at room temperature. Bhat, *et al*. (2012) in pear cv. Bartlett.

Internal colour

It is clear from Table (4.13 b) that fresh guava had dark white internal colour, but with the advancement of storage period the changes in internal colour was observed in all the treatments during storage period (Table 4.13 b).

Higher calcium content in peel and flesh in treated fruits seems to have resulted in stronger intracellular organisation and rigid cell walls (Legge *et al.*, 1982). Treated fruits are seems delayed internal colour change as compare to untreated ones. This may be due to migration of calcium from peel to inner regions during storage period. Betts and Bramlage (1977) in McIntosh apples.

Economic analysis

The unit cost for each of the treatments was calculated separately and the cost so evolved was recorded. The net profit for the same in each treatment was calculated on the particular day. Economics was calculated on the basis of market rate prevailed at that period.

A critical examination of data presented in Table 4.14 & 4.15 and revealed that varieties, plant growth regulator & nutrients was significantly influenced the net returns during 2015-16 and 2016-17. In the year of 2015-16 maximum net returns (105958 ha-1) were recorded in V_1T_9 and V_2T_9 which was followed by V_1T_4 (104123.20) on 6th day of storage during 2015-16. In the following year i.e. 2016-17, the maximum net return (112298 ha-1) were recorded in V_1T_9 and V_2T_9 which was followed by V_1T_7 V_2T_7 (109796) on 6th day of storage during 2016-17.

Chapter- VI

SUMMARY, CONCLUSION AND SUGGESTIONS FOR FUTURE WORK

6.1 Summary

The experiment entitled **"Effect of Pre-harvest Spray of GA_3, Calcium Nitrate and Potassium Sulphate on Post-harvest Behaviour of Guava (*Psidium guajava* L.) Fruits of Cultivars Dharidar and Chittidar** was carried out in the Department of Fruit Science, KNK College of Horticulture Mandsaur (M.P.) during the two successive years i.e. 2015-2016 and 2016-2017.

The present research was carried out at the Instructional cum Research Fruit Orchard, Department of Fruit Science, KNK College of Horticulture Mandsaur (M.P.), during the two years i.e. 2015-16 and 2016-17. Randomly distributed plants of guava fruits cvs. Dharidar and Chittidar of uniform age and vigour were selected. The experiment consisted of three replications and 26 treatments with randomized block design in factorial concept. The investigation consisted of treatments, *viz*., T_1- GA_3 @ 50 ppm, T_2 - GA_3 @ 100 ppm, T_3- Calcium nitrate @ 1%, T_4- Calcium nitrate @ 2%, T_5- Potassium sulphate @ 1%, T_6- Potassium sulphate @ 2%, T_7- GA_3 @ 100 ppm+ Calcium nitrate @ 2%,T_8- GA_3 @ 100 ppm+ Potassium sulphate @ 2%, T_9- GA_3 @ 50 ppm+ Calcium nitrate @ 1%+ Potassium sulphate @ 1%, T_{10}- GA_3 @ 50 ppm+ Calcium nitrate @ 2%+ Potassium sulphate @ 2%, T_{11}- GA_3 @ 100 ppm+ Calcium nitrate @ 1%+ Potassium sulphate @ 1%, T_{12}- GA_3 @ 100 ppm+ Calcium nitrate @ 2%+ Potassium sulphate @ 2% including control treatment, i.e. water spray with two cultivars i.e. Dharidar and Chittidar. All treatments were applied as foliar spray. At the optimum horticultural maturity, uniform sized fruits were harvested after 20 days of foliar spray and stored up to 9 days.

The minimum loss in physiological weight (4.68, 7.44 and 12.16%) was recorded on 3rd, 6th and 9th days respectively in guava variety Chittidar fruits stored at ambient conditions. Plant growth regulator and nutrients (GA_3, calcium nitrate and potassium sulphate) had significantly increased the loss in physiological weight as the storage period advanced irrespective of any

treatments. Treatment T_{12} (GA_3 @100 ppm + calcium nitrate @ 2% + potassium sulphate @ 2%) was recorded the minimum loss in physiological weight (2.97, 5.20 & 10.04%) followed by T_7 (3.70, 5.46 & 10.67%) on 3rd, 6th and 9th days at storage, respectively. However, maximum loss in physiological weight was recorded in control treatment. As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar, it was revealed that significant variation was noticed for physiological loss in weight, treatment, V_2T_{12} was recorded minimum loss in physiological weight (2.96, 5.09 & 9.69%) which was followed by V_1T_{12} (2.98, 5.31 and 10.12%) and V_2T_7 (3.56, 5.37 & 10.16%) on 3rd, 6rd & 9th days at storage, respectively. However, maximum losses in physiological weight (8.50, 15.69 and 24.06%) were recorded in V_1T_0.

Minimum decay loss (15.38 & 52.28%) was recorded in fruits of Chittidar guava on 6th and 9th days at storage, respectively. Plant growth regulator and nutrients (GA_3, calcium nitrate and potassium sulphate) had significantly minimized the decay loss of guava fruits in both years of experiment. Minimum decay loss (27.88%) was recorded in T_{12} followed by T_7 (28.77%) and T_{10} (33.44%) on 9th day of storage, respectively. The highest decay loss was recorded in control treatments in both years of study. As regards to interaction study revealed that significant variation was noticed for decay loss on 6th and 9th days of storage of guava fruits in both years. Pooled analysis of the data 2015-16 and 2016-17 revealed that minimum decay loss (26.81%) in V_2T_7 (Chittidar with GA_3 @ 100 ppm + calcium nitrate @ 2%), which was followed by (27.19%) in V_2T_{12} (Chittidar with GA_3 @100ppm + calci um nitrate @ 2%, potassium sulphate @ 2%) and V_1T_{12} (28.56%).

Minimum reduction in fruit size, i.e. length in fruit of cv. Chittidar & diameter was recorded in Dharidar. Application of plant growth regulator (GA_3) and nutrients alone & in conjunction had influenced the length and diameter of the fruits. The maximum fruit length (6.27 cm) and maximum diameter (6.30 cm) were recorded in T_{12} (GA_3 @ 100 ppm + calcium nitrate @ 2% + potassium sulphate @ 2%).

Chittidar variety had recorded maximum specific gravity (0.91) on 6th day of storage. Specific gravity on 9th day of storage was found non-

significant. As regards to gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) alone and in combination treatment T_{12} (GA_3 @100 ppm + calcium nitrate @ 2% + potassium sulphate @ 2%) was recorded maximum specific gravity (0.97) and (0.95) on 6th day and 9th day at storage condition which was followed by T_7 (0.95) & (0.93) on 6th day and 9th day of storage conditions, respectively.

Among two varieties, Dharidar variety had the maximum marketable fruits (47.72%) on 9th day at storage conditions. Application of plant growth regulator and nutrients revealed that significant variations were noticed for marketable fruit percentage in two year experiments. Maximum marketable fruits (72.13%) were obtained in T_{12} which was the statistically superior compare to other treatments, which was followed by T_7 (71.23%). As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar varieties, the maximum marketable fruits (73.19%) were obtained under V_2T_7 followed by V_2T_{12} (72.81%) and V_1T_{12} (71.44%). However, the minimum marketable fruits (8.78%) were obtained in V_2T_0.

Among two varieties, Dharidar had maximum (38.94%) marketable fruits retained over control. The application of different individual and combined treatments of plant growth regulator and nutrients (GA_3, calcium nitrate and potassium sulphate) proved beneficial in obtaining the maximum percentage of marketable fruits over the control. Maximum marketable fruits compared over control (63.03%) were recorded in T_{12} treatment, which was followed by T_7 (62.13%) and T_{10} (57.46%). As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with varieties, i.e. Dharidar & Chittidar the maximum marketable fruits retained over control (64.41%) were noted in V_2T_7, which was followed by V_2T_{12} (64.03%) and V_1T_{12} (62.03). However the minimum marketable fruits were retained over control (7.74%) with V_1T_5.

Fruits of variety Chittidar had the maximum TSS (11.93 and10.38^{o}B) on 6th and 9th days at storage conditions. Application of plant growth regulator and nutrients revealed that significant variations were noticed for TSS right from 0 day to 9th days at storage conditions. Pooled analysis of data 2015-16

and 2016-17 indicated that highest TSS (12.51 and 11.22 ^{o}B) was found in T_{12}, which was followed by T_{10} (12.25 & 11.08^{o}B) and T_{8} (12.08 & 10.84^{o}B) on 6th and 9th days at ambient storage conditions, respectively. As regards to interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) with Dharidar & Chittidar varieties revealed that highest TSS (12.77 and 11.35^{o}B) was found in V_2T_{12} followed by V_2T_{10} (12.46 & 11.34^{o}B) V_2T_8 (12.38 & 11.17^{o}B) on 6th and 9th days at ambient storage conditions, respectively.

Minimum pulp acidity (0.49%) was recorded in fruits of cv. Chittidar guava. There was non-significant observation recorded in 9th day of storage. Pooled analysis of data 2015-16 and 2016-17 indicated that lowest acidity (0.46%) was found in T_8 and $T_{12,}$ with had equal performance on 6th day of storage. At 9th day of storage, the minimum acidity (0.34%) was recorded with T_{12} which was followed by T_{10} (0.35%) and T_8 (0.36%). Interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) alone and in combination with Dharidar & Chittidar varieties revealed that non-significant variations were found in respect to acidity right from initial day to 9th days of ambient storage conditions.

Maximum reducing sugars (3.91%) was found in cv. Dharidar, maximum non-reducing sugars (3.45%) was recorded in Chittidar, however maximum total sugars (7.25%) was recorded in Dharidar on 9th day of storage period.

Application of plant growth regulator (GA_3) and nutrients $Ca(NO_3)_2$ and K_2SO_4 revealed treatment T_{12} was recorded the maximum reducing sugars (4.97%), non-reducing sugars (4.60%) and total sugars (9.57%) on 9th day at storage followed by T_{10} (4.74%), (4.42%) & (9.16%) and T_8 (4.54%), (4.04%) & (8.58%), respectively. Interaction study of gibberellic acid (GA_3), calcium nitrate {$Ca(NO_3)_2$} & potassium sulphate (K_2SO_4) alone and in combination with Dharidar & Chittidar varieties revealed that maximum reducing sugars (5.81%) was recorded in V_IT_{12} which was followed by V_2T_{12} (5.73%) and V_2T_{10} (5.43%) on 6th day of storage, respectively. At 9th day of storage maximum reducing sugars (5.16%) was recorded in V_IT_{12}, which was followed by V_2T_{12} (4.79%) and V_1T_{10} (4.75%) respectively. Maximum non-reducing sugars

(5.01%) was recorded in V_2T_{12} & V_2T_{10} which had equal performance as regards to non-reducing sugar content followed by V_2T_8 (4.81%) and V_1T_{12} (4.68%) on 6th day of storage, respectively. At 9th day of storage the maximum non-reducing sugars (4.75%) was recorded with V_2T_{12} which was followed by V_2T_{10} (4.49%) and V_1T_{12} (4.44%), respectively. Maximum total sugars (10.81%) was recorded in V_2T_{12} which was followed by V_1T_{12} (10.54%) and V_2T_{10} (10.52%) on 6th day of storage, respectively. While on 9th day storage conditions the maximum total sugars (9.61%) was recorded in V_1T_{12} followed by V_2T_{12} (9.54%) and V_2T_{10} (9.23%), respectively.

On 9th day of storage pooled data showed that maximum pectin (0.57%) was noted with fruits of Dharidar. Application of plant growth regulator and nutrients showed that the maximum pectin content (1.06 & 0.92%) was recorded with T_{12} which was followed by T_{10} (1.02 & 0.88) and T_7 (0.99 & 0.83%) on 6th day and 9th day at storage conditions, respectively. However, non-significant variations were found under interaction study. The initial mean pectin content (0.90%) of the fruits decreased (0.56%) by 9th days of storage.

At the end of storage period the highest score (2.91) with respect to appearance was registered in fruits of guava variety Dharidar. Application of plant growth regulator and nutrients showed that highest score (4.72) with respect to appearance was registered in T_{12} which was closely followed by T_{11} (4.43), lowest appearance (1.07) was scored in T_0, respectively. Interaction study showed that the highest score (4.74) was registered in V_1T_{12}, which was followed by V_2T_{12} (4.71) and V_2T_{11} (4.53), respectively.

At the end of storage period the highest score (3.50) with respect to taste was registered in guava variety Chittidar on 9th day of storage conditions. Application of plant growth regulator (GA_3) and nutrients ($Ca(NO_3)_2$ and K_2SO_4) showed that the highest taste score (5.33) was obtaine d with treatment T_{12} followed by T_{10} (5.28) and T_{11} (4.81) on 9th days at storag e period, respectively. Interaction study showed that at the end of storage, i.e. on 9th day of storage conditions the highest taste score (5.36) was obtained with V_2T_{12} which was closely followed by V_2T_{10} (5.33) and V_1T_{12} (5.31), respectively.

At the end of storage period the highest flavour score (3.77) was judged in guava variety of Dharidar. Application of plant growth regulator and nutrients the highest flavour score (4.73) with respect to flavour was registered in T_{12} which was closely followed by T_{11} (4.55) and T_{10} (4.39) respectively. Interaction study showed that the highest flavour score (4.79) was obtained with V_1T_{12}, which was closely followed by V_1T_{10} (4.69) and V_2T_{12} (4.67), respectively.

The highest texture score (3.05) was judged in guava variety of Dharidar. Application of plant growth regulator (GA_3) and nutrients ($Ca(NO_3)_2$ and (K_2SO_4) showed the highest texture score (4.54) with respect to flavour was registered in T_{12} which was closely followed by T_{10} (4.43) and T_{11} (3.89) on 9^{th} day at storage. Interaction study revealed that highest texture score (4.58) was obtained with V_1T_{12} which was closely followed by V_2T_{12} (4.51) and V_1T_{10} (4.44) on 9^{th} day at storage.

Fresh guava had yellowish-green colour, but with the advancement of storage period further changes in colour was observed in all the treatments.

Fresh guava had dark white internal pulp colour, but with the advancement of storage period, the changes in internal colour was observed in all the treatments during storage period.

6.2 Conclusions

The results obtained from two year investigation concluded that the guava variety Chittidar performed better in relation to decay loss, TSS & total sugars, physiological weight in loss, fruit length, specific gravity, marketable fruits, marketable fruits retained over control and taste, however variety Dharidar performed well in relation to pectin, fruit diameter, flavour and texture. As regards to plant growth regulator (GA_3 @ 100 ppm) & nutrients Ca $(NO_3)_2$ @ 2%) & K_2SO_4 @ 2%), the minimum physiological weight in loss, minimum decay loss percentage, maximum fruit size, specific gravity, marketable fruits, marketable fruits retained over control, highest TSS, low acidity, maximum reducing sugars, non reducing sugars, total sugars and sensory scores were recorded in T_{12}. In interaction study, minimum physiological weight in loss, maximum marketable fruits & maximum marketable fruits retained over control in V_2T_{12}, minimum decay loss percentage with V_2T_7, The highest TSS, and maximum total sugars were recorded in V_2T_{12}. Highest taste score was judged in V_2T_{12}, while highest score in relation to flavour & texture was judged in $V_{21}T_{12}$. However, non significant variations were observed in fruit size (fruit length & diameter), specific gravity, acidity and pectin content.

It may therefore, be recommended that the pre-harvest application of GA_3, $Ca(NO_3)_2$ @ 2% and K_2SO_4 @ 2% improve the storage-life and quality at ambient room temperatures in guava cvs. Dharidar and Chittidar.

6.3 Suggestion for Further Work

The following suggestions are made for further work on the basis of present study:

1. The present investigation entitled “Effect of Pre-harvest Spray of GA_3, Calcium Nitrate and Potassium Sulphate on Post-harvest Behaviour of Guava (*Psidium guajava* L.) Fruits of Cultivars Dharidar and Chittidar should be repeated further to confirm findings.
2. The experiment should be conducted using large number of uniform fruits.
3. Experiment should be done with same nutrient treatments with different concentrations and combinations of plant growth regulators.

4. Experiment should be done with same varieties using other different nutrient treatments at different concentrations.
5. Experiment should be done with other popular varieties for identified the best of nutrient.
6. Experiment should be done with other plant growth regulators for enhancing the fruit quality and storage-life.
7. Potassium content of the leaves/fruits should be worked out to observe its absorption.

BIBLIOGRAPHY

Abdrabboh, G.A. (2012). Effect of some pre-harvest treatments on quality of canino apricot fruits under cold storage conditions. *J. Horti. Sci. & Orna. Plants*, **4** (2): 227-234.

Amerine, M. A.; Pangborn, R. M. and Roessler, E. B. (1965). Laboratory studies: Quantity-Quality evaluation. In: *Principles of Sensory Evaluation*, Academic Press NY. pp. 367-375.

Azzolini, M.;Pedro A. J. and Spot, M. H. F. (2004). Maturation stage and post-harvest quality of 'Pedro Sato' guavas. *Revista Brasileria de Fruitcultura*, **26(1):** 29-31.

Asrey, R..; Patel, V. B.; Singh, S. K. and Sagar, V. K. (2008). Factors affecting fruit maturity and maturity standards - A review. *J. Food Sci. Technol*., **45(5):** 381-390.

A.O.A.C. (2000). Official methods of analysis 17th edn. Association of the Official Analytical chemists, Washington DC.

Ahmed, F.F. and Morsy, M.H. (2001). Response of 'canino' apricot trees grown in the new reclaimed land to application of some nutrients and ascorbic acid. The fifth Arabian Hort. Conf. Ismalia, Egypt, pp 27-34.

Aly, E.Z. and Ismail, H.A. (2000). Effect of pre-harvest GA_3, $CaCl_2$ and boron treatments on quality and enzymatic browning in Balady guava fruits. *Annals of Agricultural Science, Moshtohor*, **38** (2): 1101-1108.

Amir, M.; Chaturvedi, O. P. and Tripathi, V. K. (2003). Effect of pre-harvest application of gibberellic acid and calcium nitrate on the fruit maturity and storage quality of Kinnow mandarin. *Farm Sci. J.,* 12: 148-149.

Ali, F. Sahar (2014).Studies of some pre-harvest treatments on growth and fruit quality of guava fruits. *Journal of Agriculture and Veterinary Science,* **7** (12): 12-21.

Alila , P. and Achumi, I. (2012). Pre-harvest chemical treatments affect post-harvest quality of litchi fruit. *Acta Hortic*. 934, 755-761.

Agrawal, V. (2012). Effect of pre-harvest sprays and post-harvest dip of different chemicals on shelf-life of guava. *Inter. J. Agri. Sci.,* **8 (**1): 247-249.

Betts, H.A. and Bramlage, W.J. (1977). Uptake of calcium by apples from postharvest dips in calcium chloride solutions. *J. Am. Society. Hortic. Sci.,* **102** (6): 785-788.

Bhat, M.Y.; Ahsan, Hafija, Bandy, F.A.; Dar, M.A.; Wani Imtiyaz, A. and Hassan, G.I. (2012). Effect of harvest dates, pre-harvest calcium sprays and storage period on physico-chemical characteristics of pear cv. Bartlett. *Journal of Agricultural Research and Development,* **2**(4) pp. 101-106.

Bisen, Sarad.; Thakur, R.S. and Tembhare, Dharna (2014). Effect of calcium nitrate and gibberellic acid application on growth, fruit quality and post-harvest behaviour of guava fruit. *The ecoscan,* special issue (14): 55-62.

Boora, R. S. (2012). Improvement in guava (*Psidium guajava* L.) – A review. *Agric. Rev*. **33**(4): 341-349.

Bron, I. U.; Ribeiro,R. V.; Cavalini, F. C.; Jacomino, A. P. and Trevisan, M. J. (2005). Temperature related changes in respiration and Q10 coefficient of guava. *Scientia Agricola*., **62(5):** 458-463.

Brahmachari, V.S. and Rani, R. (2005). Shelf-life extension in guava with pre-harvest spray of certain growth substances and polyethylene wrapping. *Haryana Journal of Horticulture Science*, 34: 36-38.

Bengerth, F. (1979). Calcium regulated physiological disorder in plants. *Ann. Rev. Phytopathology*, **17:** 97-99.

Burondkar, M. M.; Jadhav, B. B. and Chetti, M. B. (2009). Effect of plant growth regulators, polyamine and nutrients on fruit quality and occurrence of spongy tissue in Alphonso mango. *Acta Horti.*, 820: 689-696.

Brummell, D.A.; Dal Cin, V.; Crisosoto, C.H. and Labavitch, J.M. (2004). Cell wall metabolism during maturation, ripening and senescence of peach fruit. *J Exp Bot*., 55:2029–2039.

Banday, F.A. (1996). Cold Storage Studies in Pear *cv*. LeConte. Ph.D. Dissertation, Punjab Agriculture University, Ludhiana.

Bhatt, A.R.; Sofi, A.G.; Mir, M.A. and Gani, M.R. (1997). Effect of pre- harvest sprays of calcium and potassium on some quality characteristics of cherry cv. Makhmali. *Indian J. Hortic.*, 54(1):19-24.

Cheour, F.; Willemot, C.; Arul, J.; Desjardins, Y.; Makhlouf, J.;Charent, P.M. and Gosselin, A. (1990). Foliar application of calcium chloride delay post harvest ripening of strawberry. *J. Amerc. Soc. Hort. Sci*., **115:** 789-792.

Chundawat, B. S.; Gupta, A. K. and Singh, B. P. (1978). Storage behaviour of different grades of kinnow fruits. *Punjab Hort. J.,* 18: 156-160.

Chauhan, Bal Bahadur Singh, Shukla, P.K.; Yadava,L.P. and Verma, Deepmala (2014). Effect of pre-harvest foliar spray of Ca, Zn and B on respiration rate and biochemical changes of 'Dashehari' mango during storage. *African Journal of Agricultural Marketing,* ***2****(1):047-055.*

Chahal, S. and Bal, J. S. (2003). Effect of post-harvest treatments and packaging on shelf-life of 'Umran' ber at cool temperature. *J. Res. Punjab. Agri. Univ.,* **40:** 363-370.

Chouhan, P.;Singh, J.P.;Kaushik, Himanshu,Singh,R.K.and Rajbeer (2015). Effect of pre-harvest foliar spray of nutrients and plant bio-regulators on shelf-life and quality of fruit of mango cv. Dashehari. *The Asian Journal of Horticulture,* **10**(2): 246-250.

Chahal, Tanjeet Singh and Bal, J. S. (2012). Effect of pre-harvest treatments of calcium salts on harvest maturity in Kinnow mandarin. *Hort Flora Research Spectrum,* **1**(2): 153-157.

Dutta, P. (2004). Foliar potassium spray in improving the quality of Sardar guava (*Psidium guajava* L.). *Orissa Journal of Horticulture*, **32** (1): 103-104.

Deepthi, Phani V.; Sekhar, Chandra R.; Srihari ,D. and Sankar, Siva A.(2016). Guava fruit quality and storability as influenced by harvest maturity and postharvest application of calcium salts**.** *Plant Archives,* **16** (1):174-182.

Desai ,V.N.; Satodiya, B.N. and Khatana, K.J.(2017). Influence of pre-harvest spraying treatments of chemicals and plant growth regulators on physical parameters, post-harvest losses and shelf-life of sapota [*Manilkara achras* (Mill.) Forsberg] fruits cv. Kalipatti. *Journal of Pharmacognosy and Phytochemistry*, **6** (5): 576-578.

Dhaliwal, G.S. and Singla, R. (2002). Studies on the time of anthesis and dehiscence in different genotypes of guava in winter and rainy season crops. *Indian J Hort*., 59:157–161.

Farag, K.M. and Kassem, H.A. (2000). Effect of naphthalene acetic acid, calcium, phosphorus, or potassium on fruit quality, abscission and the shelf-life of guava fruits. *Emir. J. Agric. Sci.,* 12: 01-19.

Fry, S.C. (2004) Primary cell wall metabolism: tracking the carriers of wall polymers in living cells. New Phytol 161:641–675.

Gupta, O.P.; Jindal, P.C. and Singh, B.P. (1980). Effect of pre-harvest spray of calcium nitrate on the storage behavior of grapes cv. Perlette. *J. Res. Haryana Agric. Univ.,* 10: 204-206.

Gupta, Neeraj and Singh, V.B. (2016). Pre-harvest foliar application of calcium chloride, bavistin and bayleton on post-harvest life of *Emblica officinalis* Gaertn. fruits. *Bangladesh J. Bot*., **45** (1): 211-219.

Goutam, Mandal, Dhaliwal, H. S. and Mahajan, B. V. C. (2010). Effect of pre-harvest calcium sprays on post-harvest life of winter guava (*Psidium guajava* L.**).** *J. Food Sci. Technol*, **47 (**5): 501–506.

Goswami, A.K.; Shukla,H.S; Kumar, Prabhat, and Mishra, D.S. (2012). Effect of pre-harvest application of micro-nutrients on quality of guava (*Psidium guajava* L.) cv. Sardar. *Hort Flora Research Spectrum*, **1**(1):60-63.

Goswami , Amit Kumar.; Shukla, H.S. and Mishra, D.S. (2014). Influence of pre-harvest nutrients application on the physico-chemical quality and storage behaviour of guava (*Psidium guajava* L.) fruit cv. L-49. *Progressive Horticulture, 46, (1): 54-57.*

Gupta, O.P.; Singh, B.P.; Singh, S.P. and Chauhan, K.S. (1984). Effect of calcium compounds as pre-harvest spray on the shelf-life of peach cv. 'Sharbati'. *Punjab Hort J*., 24:105–110.

Huber, D.J. (1983). Role of cell wall hydrolases in fruit softening. *Horti. Rev.* 5: 169-171.

Hansen, E. (1966). Postharvest physiology of fruit. *Annu. Rev. Plant Physiol*., 17: 459-480.

Huang, C. C. (1974).Maintaining freshness of pineapple fruits for export. *Taiwan Agril. Quarterly,* **10**: 103-11.

Hayat, I.; Masud, T. and Rathore, H. A. (2003). Effect of coating and wrapping material on the shelf-life of Apple (*Malus domestica*) *cv*. Borakh. *Internet J. Food Safety*, **5** (5): 24-34.

Jawandha, S.K.; Randhawa, J. S.; Gill, P. P. S. and Singh, Jagjit, (2008). Effect of post-harvest treatment on storage quality in 'Umran' ber fruit. *J. Hortl. Sci., **3*** (1): 48-52.

Jakhar, M. S. and Pathak S. (2014). Enhancing quality of mango (*Mangifera indica* L.) fruits cv. Amrapali with pre-harvest foliar spray and fruit bagging. *Annals of Agri Bio Research*, **19** (3):488-49.

Jakhar, M. S. and Pathak S. (2015). Influence of hot water treatment and wax coating on quality and storage- life of mango (*Mangifera indica* L.) fruits cv. Amrapali under ambient condition. *The ecoscan,* **9** (3&4): 745-750.

Jakhar, M. S. and Pathak S. (2016). Effect of pre-harvest nutrients application and bagging on quality and shelf- life of mango (*Mangifera indica* L.) fruits cv. Amrapali. *Journal of Agricultural Science & Technology*, **18** (3): 717-729.

Jayachandran, K.S.; Srihari, D. and Reddy, Narayana Y. (2005). Pre-harvest sprays of different sources of calcium to improve the shelf-life of guava. *Indian J. Hort.,* **62** (1): 68-70.

Jagtiani, J.; Chan, H.T. and Jr, Sakai, W.S. (1988). Tropical fruit processing. Academic Press Inc., New York, pp 9–43.

Kader, A. A. (1999). Guava-produce facts. *Perishables Handling Quarterly*, University of California, Davis. **97:**19-20.

Kirmani,S.N.; Wani, G.M.; Wani, M.S.; Ghani, M.Y.; Abid, M.; Mujamil, S.; Raja, H. and Malik, A.R. (2013). Effect of pre-harvest application of calcium chloride ($CaCl_2$), gibberlic acid (GA_3) and napthelenic acetic acid (NAA) on storage of plum (*Prunus salicina* L.) cv. Santa Rosa under ambient storage conditions. *African J. Agril. Research*, **8** (9): 812-818.

Kumar, Jitendra, Kumar, Rajesh, Rai ,Ratna and Mishra ,D. S. (2015). Response of 'Pant prabhat guava trees to foliar sprays of zinc, boron, calcium and potassium at different plant growth stages. *The Bioscan,* **10** (2): 495-498.

Kassem, H.A.; Al-Obeed, R.S.; Ahmed, M.A. and Omar, A.K.H. (2011). Productivity, fruit quality and profitability of jujube trees improvement by pre-harvest application of agro-chemicals. *Middle-East Journal of Scientific Research,* **9** (5): 628-637.

Kher, R.; Bhat, S. and Wali, V. K. (2005). Effect of foliar application of GA_3, NAA and CCC on physico-chemical characteristics of guava cv. sardar , *Haryana J. Hort. Sci*., **34**(1-2)**:** 31-32.

Koksal, A. L.; Dumanoglu, H. and Tuna, N. (1994). The effect of simper fresh on the storage of 'Williams' Pear and 'Starkspur Golden Delicious' apple cultivars. *Acta Horti.*, **368**: 793-801.

Karemera, N. J. U. and Habimana, S. (2014). Performance of calcium chloride sprays on ripening, shelf-life and physical chemical proprieties of Mango fruits (*Mangifera indica* L.) *cv.* Totapuri. *International J. Agril. Soil Sci.*, **2(3)**: 33-38.

Karemera, N.J. Umuhoza, Habimana, Sylvestre (2014). Effect of pre-harvest calcium chloride on post-harvest behavior of mango fruits (*Mangifera indica* L.) cv. Alphonso. *Universal Journal of Agricultural Research,* **2** (3): 119-125.

Kazemi, M.; Aran, M. and Zamani, S. (2011). Effect of calcium chloride and salicylic acid treatment and quality characteristics of kiwifruit (*Actinida deliciosa* cv. Hayward) during storage. *American J. Plant Physiol*. **6**: 183-89.

Kumar,Rajesh, Lal, Shant and Misra, K.K.(2012). Effect of post-harvest calcium treatments on shelf life of guava cv. Sardar. *Hort Flora Research Spectrum,* **1**(4): 344-347.

Kertesz, Z.I. (1951). The Pectic Substances. *Interscience Publishers*, New York.

Lal, D.; Tripathi, V.K.; Kumar, S. and Nayyer, M.A. (2015). Effect of pre-harvest application of gibberellic acid, NAA, and calcium nitrate on fruit drop, maturity and storage quality of Kinnow mandarin. *Res. Environ. Life Sci.,* **8** (4):561-564.

Legge, R.L.; Thompson, J.E.; Baker, J.E. and Lieberman, H. (1982). The effect in calcium on the fluidity and phase properties of microsomal membranes isolated from post-climacteric Golden Delicious apples. *Plant. Cel.l Physiol*., **23**(2): 161-169.

Loony, N.E. (1972). Interaction of harvest maturity, cold storage and two growth regulators on ripaning of Bartlett pears. *J. Am. Society. Hortic. Sci.* **97**(1): 81-83.

Lal, S.; Tiwari, J.P. and Misra, K.K. (2000). Effect of plant spacing and pruning intensity on fruit yield and quality of guava. *Prog Hort*., 32:20–25.

Lal, S.; Kumar D.; Singh, D.; Ahmed, N.; Kumar, R. and Dar G. (2011). Effect of pre-harvest application of calcium chloride and gibberellic acid on shelf-life and post-harvest quality of apricot (*Prunus Armeniaca* L.) cv. Harcot. *J. Horti. Sci.*, **6**(1):46-51.

Mandal, Goutam, Dhaliwal, H. S. and Mahajan, B. V. C. (2010). Effect of pre-harvest calcium sprays on post-harvest life of winter guava (*Psidium guajava* L.). *J Food Sci Technol*, **47**(5):501–506.

Mitra, S.K. and S.S. Dhaliwal (2009). Effect of potassium on fruit quality and their storage life. Proceedings on potassium role and benefits in improving nutrient management for food production , quality and reduced environmental damages Bhubnashwar, November 5-7. IPI-OUAT-IPNI International Symposium Bhubaneswar, Orissa, India pp.327.

Mitra, S. K.; Gurung, M. R. and Pathak, P. K. (2008). Guava production and improvement in India: An overview. *Acta Hort*., 787: 59-65.

Mishra, Krishna Kumar, Pathak, Sanjay, Sharma, Nitish and Nehal, Nikita, (2017). Effect of pre-harvest nutrients spraying on physicochemical quality and storage behaviour of rainy season guava (*Psidium guajava* L.) fruits cv. L-49. *Plant Archives,* **17** (1): 597-600.

Mahajan, B. V. C.; Randhawa, J. S.; Harminder, Kaur and Dhatt, A. S. (2008). Effect of post-harvest application of calcium nitrate and gibberellic acid on the storage life of plum. *Ind. J. of Hort*., **65** (1): 94-96.

Manivannan, M.I.; Irulandi, S. and Shoba Thingalmaniyan, K. (2015). Studies on the effect of pre-harvest application of plant growth regulators and chemicals on yield and quality of guava (*Psidium guajava* L.) cv. L.-49. *International Journal of Agricultural Sciences,* **11** (1):138-140.

Mahajan, B. V. C.; Ghuman, B. S. and Harsimrat, K. B. (2011). Effect of post-harvest treatments of calcium chloride and Gibberellic acid on storage behavior and quality of guava fruits. *J. Horticultural Science and Ornamental Plants,* **3**(1): 38-42.

Mitra, S. K.; Devi, H. L.; Chakraborty, I. and Pathak, P. K. (2012). Recent development in post-harvest physiology and storage of guava. *Acta Hort*., 959: 89-95.

Marzouk, H.A. and Kassem,H.A. (2011). Improving yield, quality and shelf-life of Thompson seedless grapevine by pre-harvest foliar applications. *Sci Hortic*, 130: 425-430.

Mercado-Silva, E.; Benito-Bautista, P. and Garcia-Velasco, M. A. (1998). Fruit development, harvest index and ripening changes of guavas produced in central Mexico. *Postharvest Biol. Technol*., **13:** 143-150.

NHB (2014). Data base 2014, National Horticulture Board (NHB), Gurgaon. Department of Agriculture & Cooperation, Govt. of India pp.76-83./http//www.nhb.co.in.

Nelson, N. (1944). A photometric adoption of the somogui method for the determination of glucose. *J. Biol. Chem*. 153: 375-380.

Nguyen Minh Tuan and Yen Chung–Ruey (2013). Effect of gibberellic acid and 2, 4-Dichlorophenoxyacetic acid on fruit development and fruit quality of wax apple. *International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering* **7** *(5): 299-305.*

Nishad, Praveen Kumar, Vikram, Balaji and Prasad, V. M. (2012). Effect of chemicals on shelf-life and quality of guava (*Psidium guajava* L.) fruits cv. Apple Colour**.** *Hort Flora Research Spectrum,* **1**(3): 220-224.

Omayma, M. Ismail , Abd El-Moniem , Eman, A.A.; Abd- Allah ,A.S.E. and El-Naggar ,M.A.A. (2010). Influence of some post-harvest treatments on guava fruits. *Agric. Biol. J. N. Am.*, 2010, **1**(6): 1309-1318.

Prasad, B.; Dimiri, D.C. and Bora, L. (2015).Effect of pre-harvest foliar spray of calcium and potassium on fruit quality of pear cv. Pathernakh. *Scientific Research and Essays*, **10** (11):376-380.

Patel, Urvashi, varu, D.K. and Chaudhari, Jamsu, (2015). Effect of pre-harvest spray of chemicals on shel-flife and quality of mango cv. Keshar. The Asian Journal of Horticulture.**10** (2) | December, 2015 187-193.

Patel, R. K.; Maiti, C. S.; Deka, B. C.; Deshmukh,N. A.; Verma, V. K. and Nath, A. (2015). Physical and biochemical changes in guava (*Psidium Guajava* L.) during various stages of fruit growth and development. *International Journal of Agriculture, Environment and Biotechnology*, **8(1):** 75–82.

Patel, H.A.;Patel, M.J.;Vasara, Riddhi, Patel, N.G. and Sutariya, N.K. (2017). Effect of pre-harvest spray of calcium on bio-chemical parameters of sapota [*Manilkara achras* (Mill.) Forsberg] fruits cv. Kalipatti. *Journal of Pharmacognosy and Phytochemistry*, **6** (5): 712-715.

Parkhe, P.B.; Kulkarni, S.S.; Durgude, R.A. and Mali, D.S. (2015) .Effect of chemicals on yield and quality of guava *(Psidium guajava* L.) cv. Sardar. *Bioinfolet,* **12** (2 B): 491 – 493.

Panwar, Nitin, Kumar, Jitendra, Rai, Pradumn Narain, Mishra, Daya Shankar and Chandola, Jitendra Chandra (20017).Effect of pre-harvest foliar sprays of different chemicals on fruit quality and shelf-life of litchi fruits. *International Journal of Chemical Studie*s, **5** (4): 419-424.

Panse, V.G. and Sukhatme, P.V. (1985). Statistical methods for agricultural workers, 4th edn. Indian Council of Agricultural Research, New Delhi.

Pisutpiboonwong, Nattakarn and Khurnpoon, Lampan (2017). Effect of pre-harvest calcium chloride sprayed on growth and development and quality of mulberry fruit. *International Journal of Agricultural Technology* **13**(7.1): 1317-1324.

Paull, R. E. and Chen, C. C. (2002). Guava postharvest technology research and information centre. http://

postharvest.ucdavis.edu/Produce/Produce Facts/Fruit/ guava_graphics.shtml.

Rajput, B.S.; Lekhe, R.; Sharma, G.K. and Singh, L. (2008). Effect of pre and post-harvest treatments on shelf- life and quality of guava fruits (*Psidium guajava* L.) cv. Gwalior-27. *The Asian Journal of Horticulture*, **3** (2): 368-371.

Rajput, B. S. (2010). Effect of pre-harvest application of calcium compounds on chemical quality of guava fruits *(Psidium guajava* L.*)* cv. Gwalior –27. *Inter. J. Proc. & P. H. Tech.,* **1(**2): 59-61.

Rokaya, P.; Baral, D.; Gautam, D.; Shrestha, A. and Paudyal, K. (2016). Effect of pre-harvest application of gibberellic acid on fruit quality and shelf-life of mandarin (*Citrus reticulata* Blanco). *American Journal of Plant Sciences*, 7:1033-1039.

Rees, D.A. (1975). Steriochemistry and binding behaviour of carbohydrate chains. In *Biochemistry of Carbohydrates* . MTP I (Ed. W.J. Whelan), Butterworths, London, Unv. Park Press, Baltimore, *Inst. Rev. Sci. Biochem. Ser*., p. 5.

Rokaya, P.; Baral, D.; Gautam, D.; Shrestha, A. and Paudyal, K. (2016). Effect of pre-harvest application of gibberellic acid on fruit quality and shelf-life of Mandarin (*Citrus reticulata* Blanco). *Am J. Plant Sci.* **7**: 1033-1039.

Rajkumar M.; Karuppaiah, P. and Kandasamy, R. (2005). Effect of calcium and gibberellic acid on post-harvest behaviour of papaya cv. CO-2. *Ind. J. of Hort.,* **62** (4): 327-331.

Randhawa, J. S.; Jawandha,S. K.; Mahajan, B. V. C. and Gill, P. P. S. (2009). Effect of different post-harvest treatments on quality of ber fruit during cold storage. *J. Food Sci. Technol*., **46(2):** 174-176.

Rhodes, M.J.C.; Woodtorton, L.S.C.; Gallard, T. and Hulme, A.C. (1968). Metabolic changes in excised fruit tissue I. Factor affecting the development of a malate decarboxylation system during the ageing of disc of pre-climecteric apples. *Phytochem,* 7:271–276.

Sharma, Shashi, K. and Pratima, Preet, (2018). Effect of pre-harvest gibberellic acid and calcium application on post-harvest behaviour of subtropical peaches. *Current Agriculture Research Journal,* **06**(1): 78-84.

Selvan, M. T. and Bal, J. S. (2005). Effect of different treatments on the shelf-life of Sardar guava during cold storage. *J. R. P. Agri. University,* **42** (1): 28-33.

Singh, Gorakh (1998). Effect of calcium nitrate and plant growth regulators on the storage of Allahabad Safeda guava. *Ind. J. of Hort.,* **45** (1/2): 45-50.

Singh, A. (1988). Effect of calcium nitrate and plant growth regulators on the storage of Allahabad Safeda guava. *Indian J. Hort.* **45(1-2):** 45- 50.

Singh, K. (1980). Effect of various chemicals as pre and post-harvest application on shelf-life of guava at various temperatures. *Ph.D. Thesis, Haryana Agric. Univ*., Hisar, India.

Singh, G. (2007). Recent development in production of guava. *Acta Hort*., **735:** 161-176.

Singh, R.; Chaturvedi, O.P.; Guar, G.S. and Singh, G. (2007). Effect of pre-harvest spray of zinc, calcium and boron on the storage behaviour of guava (*Psidium guajava* L.) fruits cv. 'Allahabad Safeda'. *Acta Hort* 735:633–638

Singh, B.P.; Pandey, G.; Sarolia, D.K.; Pandey, M.K. and Pathak, R.K. (2004). Shelf-life evaluation of aonla cultivars. *Indian Journal of Horticulture* **62(2):** 137-140.

Singh, S.; Singh, A.K.; Joshi. H.K.; Bagle, B.G, and Dhandar, D.G. (2008). Storability of ber (*Zizyphus mauritiana* Lamk) fruit in semi arid environment. *J Food Sci Technol* 45:65–69.

Singh, G. (1988). Effect of calcium nitrate and plant growth regulators on the storage of Allahabad Safeda guava. *Indian J. Hort*., **45(1-2):** 45-50.

Sharma, Shashi K. and Pratima, Preet,(2018). Effect of pre-harvest gibberellic acid and calcium application on post-harvest behaviour of subtropical peaches. *Current Agriculture Research Journal,* 6 (1): 78-84.

Singh, K. (1980). Effect of various chemicals as pre and post harvest application on shelf life of guava at various temperatures. *Ph.D. Thesis, Haryana Agric. Univ.*, Hisar, India.

Singh, Amit Kumar,Shukla, H.S.; Kumar, Harit,Singh, Vaibhav and Singh, R.R. (2014). Effect of gibberelic acid and calcium nitrate on the physiological and physico-chemical changes and shelf-life of aonla (*Emblica officinalis* Gaertn) fruits. *International Journal of Farm Sciences* 5(2): 140-145.

Singh, K. and K. S. Chauhan (1981). Effect of pre-harvest application of calcium, potassium and alar on pectin content and activity of PME and cellulase of guava fruits during storage. *Haryana J. Hort. Sci*., **10:** 177-181.

Sen, A.; Meyvaci, K.B.; Can, H.Z. and Teksur, P.K. (2012). Effect of pre-harvest gibberellic and calcium applications on-tree storage of Satsuma mandarins. *Proceedings of the VII International Post-harvest Symposium*, 25-29 June 2012, 233-239. http://www.actahort.org/books/1012/1012_26.

Sudha,R.; Amutha,R.; Muthulaksmi, R. S.; Baby Rani, W.; Indira, K. and Mareeswari, P. (2007). Influence of pre and post-harvest chemical treatments on physical characteristics of sapota (*Achras sapota* L.) var. PKM 1. *Research Journal of Agriculture and Biological Sciences*, 3(5): 450-452.

Srivastava, M.P. and Tandon, R.N. (1968).Influence of temperature on botryodiplodia rot of citrus and sapota. *Indian Phytopathol*, 21:195–207.

Tirimazi, S.I.H. and Wells, R.B.H. (1981). Retardation of ripening of mangoes by post-harvest application of calcium. *Tropic. Agric.*, 58: 137-139.

Tandon, D. K.; Singh, B. P. and Kalra, S. K. (1989). Storage behaviour of specific-gravity-graded guava fruits. *Sci. Hort*., **41(1-2):** 35-41.

Vishwakarma, Pradeep Kumar, Masu, M.M. and Singh, Sumit, (2017). Effect of pre-harvest application of different chemicals and plant growth regulators on physical parameters and shelf-life of fruits of mango (*Mangifera indica* L.) cv. Amrapali. *International Journal of Chemical Studies*, **5** (4): 350-354.

Yadav, L. and Varu, D. K. (2013). Effect of pre-harvest spray and post-harvest dipping of fruit on shelf-life and quality of papaya. *Asian J. of Hort*., **8**(2): 581-587.

APPENDICES

Appendix-I

Source of variation	D. F.	M.S.S.					
		PLW at 3 day		PLW at 6 day		PLW at 9 day	
		2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
REP	2	0.0214	0.001451	0.000309	0.009842	0.001605	0.008959
V	1	2.5851	2.502063	5.061755	3.016867	28.17608	18.52257
T	12	9.2770	9.510325	35.93504	35.18833	45.4549	55.10032
V X T	12	0.2172	0.231021	0.578291	0.638053	2.628493	3.016918
Error	50	0.0123	0.00265	0.001926	0.003189	0.002213	0.003039
Total	77						

Analysis of variance for physiological weight in loss (%) during storage period

Source of variation	D. F.	M.S.S.		
		PLW at 3 day	PLW at 6 day	PLW at 9 day
		Pooled	Pooled	Pooled
REP	4	0.044007	0.39258	0.013982
YEAR	1	0.130385	1.550016	0.034801
V	1	5.086852	7.947078	46.19431
T	12	18.78418	71.02107	100.1796
V X T	12	0.446564	1.191	5.570054
Y XV X T	12	0.42876	0.800862	4.34258
Error	117	0.006788	0.00236	0.002425
Total	155			

Appendix-II

Analysis of variance for decay loss (%) during storage period

Source of variation	D. F.	M.S.S.			
		Decay loss at 6 day		Decay loss at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.005944	0.016001	0.003265	0.012258
V	1	8.193313	79.40628	17.55128	57.10548
T	12	2488.646	2649.581	2624.847	2616.46
V X T	12	2.146863	7.106738	4.335401	5.99671
Error	50	0.011492	0.0079	0.016228	0.037462
Total	77				

Source of variation	D. F.	M.S.S.	
		Decay loss at 6 day	Decay loss at 9 day
		Pooled	Pooled
REP	4	9.522449	29.34444
YEAR	1	38.04591	117.3467
V	1	69.30667	68.9871
T	12	5135.374	5239.003
V X T	12	7.452318	8.301203

Y XV X T	12	11.95478	10.5567
Error	117	0.008662	0.02321
Total	155		

Appendix-III

Analysis of variance for fruit length (cm) during storage period

Source of variation	D. F.	M.S.S.			
		Fruit length at 0 day		Fruit length at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.000565	0.041794	0.000994	0.004492
V	1	2.143396	2.785482	1.484328	2.729078
T	12	0.079862	0.070267	0.138159	0.114382
V X T	12	0.004713	0.001171	0.001645	0.001781
Error	50	0.001293	0.006119	0.001376	0.001806
Total	77				

Source of variation	D. F.	M.S.S.	
		Fruit length at 0 day	Fruit length at 3 day
		Pooled	Pooled
REP	4	0.113987	0.069828
YEAR	1	0.371231	0.268339
V	1	4.907878	4.119375
T	12	0.148785	0.251011
V X T	12	0.003071	0.001228
Y XV X T	12	0.414897	0.354846
Error	117	0.003892	0.001454
Total	155		

Source of variation	D. F.	M.S.S.			
		Fruit length at 6 day		Fruit length at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.006035	0.00176	0.001021	0.001435
V	1	1.666154	1.860026	1.734063	2.093954
T	12	0.255389	0.260664	0.418258	0.417296
V X T	12	0.000437	0.000636	0.000438	0.001968
Error	50	0.002336	0.002649	0.00083	0.001073
Total	77				

Source of variation	D. F.	M.S.S.	
		Fruit length at 6 day	Fruit length at 9 day
		Pooled	Pooled
REP	4	0.053885	0.050947
YEAR	1	0.19995	0.198878
V	1	3.523513	3.819539
T	12	0.514938	0.834829
V X T	12	0.000909	0.001486

Y XV X T	12	0.295128	0.320645
Error	117	0.002264	0.000855
Total	155		

Appendix-IV

Analysis of variance for fruit diameter (cm) during storage period

Source of variation	D. F.	M.S.S.			
		Fruit diameter at 0 day		Fruit diameter at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.00644	0.005217	0.01295	0.003832
V	1	17.15508	17.80837	16.60616	16.47721
T	12	0.053674	0.061732	0.053018	0.06052
V X T	12	0.000488	0.000284	0.000477	0.000587
Error	50	0.002012	0.004189	0.000903	0.001769
Total	77				

Source of variation	D. F.	M.S.S.	
		Fruit diameter at 0 day	Fruit diameter at 3 day
		Pooled	Pooled
REP	4	0.012695	0.013817
YEAR	1	0.027467	0.021703
V	1	34.9604	33.08324
T	12	0.115164	0.113262
V X T	12	0.00057	0.000656
Y XV X T	12	2.914065	2.757631
Error	117	0.002849	0.001429
Total	155		

Source of variation	D. F.	M.S.S.			
		Fruit diameter at 6 day		Fruit diameter at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.000159	0.005501282	0.000924	0.004371
V	1	15.93933	17.69387821	16.97733	21.29971
T	12	0.144201	0.160965385	0.25126	0.25931
V X T	12	0.000428	6.1538505	0.00026	0.000307
Error	50	0.002459	0.003041282	0.00121	0.003581
Total	77				

Source of variation	D. F.	M.S.S.	
		Fruit diameter at 6 day	Fruit diameter at 9 day
		Pooled	Pooled
REP	4	0.008676	0.00341
YEAR	1	0.023385	0.003052
V	1	33.61031	38.15463
T	12	0.304634	0.510208
V X T	12	0.0003	0.000455

Y XV X T	12	2.803489	3.190227
Error	117	0.002447	0.002138
Total	155		

Appendix-V

Analysis of variance for specific gravity during storage period

Source of variation	D. F.	M.S.S.			
		Specific gravity at 0 day		Specific gravity at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.001232	0.000513	0.000865	0.00015
V	1	0.025851	0.026955	0.012313	0.014678
T	12	0.007079	0.010271	0.008104	0.008599
V X T	12	0.000196	0.000108	0.000224	0.000198
Error	50	0.001095	0.000711	0.001008	0.000693
Total	77				

Source of variation	D. F.	M.S.S.	
		Specific gravity at 0 day	Specific gravity at 3 day
		Pooled	Pooled
REP	4	0.001116	0.000682
YEAR	1	0.000975	0.000698
V	1	0.052801	0.026939
T	12	0.016987	0.016505
V X T	12	0.00021	0.000345
Y XV X T	12	0.004856	0.002524
Error	117	0.000802	0.000744
Total	155		

Source of variation	D. F.	M.S.S.			
		Specific gravity at 6 day		Specific gravity at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.002181	0.000928	0.003473	0.002632
V	1	0.006282	0.003335	0.000621	0.002051
T	12	0.009579	0.009282	0.008773	0.008774
V X T	12	0.007095	0.000118	0.009705	0.000196
Error	50	0.00085	0.000691	0.00119	0.000875
Total	77				

Source of variation	D. F.	M.S.S.	
		Specific gravity at 6 day	Specific gravity at 9 day
		Pooled	Pooled
REP	4	0.002274	0.003453
YEAR	1	0.002878	0.001603
V	1	0.009385	0.002464
T	12	0.018772	0.017475
V X T	12	0.000171	0.000206

Y XV X T	12	0.000908	0.000375
Error	117	0.000712	0.000987
Total	155		

Appendix-VI

Analysis of variance for marketable fruits during storage period

Source of variation	D. F.	M.S.S.			
		Marketable fruits at 6 day		Marketable fruits at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.005944	0.016001282	0.003265	0.012258
V	1	8.193313	79.40628205	17.55128	57.10548
T	12	2488.646	2649.581267	2624.847	2616.46
V X T	12	2.146863	7.106737607	4.335401	5.99671
Error	50	0.011492	0.007899949	0.016228	0.037462
Total	77				

Source of variation	D. F.	M.S.S.	
		Marketable fruits at 6 day	Marketable fruits at 9 day
		Pooled	Pooled
REP	4	9.522449	29.34444
YEAR	1	38.04591	117.3467
V	1	69.30667	68.9871
T	12	5135.374	5239.003
V X T	12	7.452318	8.301203
Y XV X T	12	11.95478	10.5567
Error	117	0.008662	0.02321
Total	155		

Appendix-VII

Analysis of variance for marketable fruits retained over control during storage period

Source of variation	D. F.	M.S.S.			
		Marketable fruits retained over control at 6 day		Marketable fruits retained over control at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.450794	1.6251	0.044065	0.054037
V	1	49.61646	0.6408	0.290482	0.28345
T	12	2488.646	2649.5813	2624.847	2616.46
V X T	12	2.146863	7.1067	4.335401	5.99671
Error	50	0.114522	0.0277	0.016376	2161.554
Total	77				

Source of variation	D. F.	M.S.S.	
		Marketable fruits retained over control at 6 day	Marketable fruits retained over control at 9 day
		Pooled	Pooled
REP	4	20.94713	27.0031
YEAR	1	79.63674	63.03016

V	1	19.48987	150.8433
T	12	5135.374	5239.003
V X T	12	7.452318	8.301203
Y XV X T	12	8.842922	27.96405
Error	117	0.096262	0.02476
Total	155		

Appendix-VIII

Analysis of variance for TSS (^{0}Brix) during storage period

Source of variation	D. F.	M.S.S.			
		TSS at 0 day		TSS at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.009267	0.004324	0.032723	0.002578
V	1	17.48493	16.71708	15.44595	21.77262
T	12	2.383376	2.421268	2.857136	2.393212
V X T	12	0.208571	0.187873	0.295258	0.192511
Error	50	0.008365	0.004314	0.00898	0.002584
Total	77				

Source of variation	D. F.	M.S.S.	
		TSS at 0 day	TSS at 3 day
		Pooled	Pooled
REP	4	0.163229	0.153292
YEAR	1	0.625733	0.542564
V	1	34.1977	36.94773
T	12	4.804233	5.118172
V X T	12	0.393597	0.389392
Y XV X T	12	2.853425	3.3321
Error	117	0.005651	0.005545
Total	155		

Source of variation	D. F.	M.S.S.			
		TSS at 6 day		TSS at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.049071	0.001217	0.042867	0.237203
V	1	19.60013	24.382463	12.49601	11.48468
T	12	2.836339	2.263674	3.627857	45.52492
V X T	12	0.214623	0.292238	0.300661	4.054872
Error	50	0.006569	0.017809	0.007472	0.69
Total	77				

Source of variation	D. F.	M.S.S.	
		TSS at 6 day	TSS at 9 day
		Pooled	Pooled
REP	4	0.154663	0.117197
YEAR	1	0.518078	0.145852

V	1	43.85221	23.97002
T	12	5.030542	7.415947
V X T	12	0.44206	0.63382
Y XV X T	12	3.799487	2.00879
Error	117	0.011277	0.011876
Total	155		

Appendix-IX

Analysis of variance for acidity (%) during storage period

Source of variation	D. F.	M.S.S.			
		Acidity at 0 day		Acidity at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.000581	0.009588	0.001642	0.003671
V	1	0.035755	0.034904	0.013601	0.013078
T	12	0.005669	0.005404	0.006287	0.005295
V X T	12	0.000341	0.00054	0.001124	0.0013
Error	50	0.001431	0.001691	0.00172	0.001885
Total	77				

Source of variation	D. F.	M.S.S.	
		Acidity at 0 day	Acidity at 3 day
		Pooled	Pooled
REP	4	0.005783	0.004196
YEAR	1	0.002792	0.006156
V	1	0.070656	0.026677
T	12	0.011034	0.011538
V X T	12	0.00082	0.002384
Y XV X T	12	0.005989	0.002307
Error	117	0.001508	0.001631
Total	155		

Source of variation	D. F.	M.S.S.			
		Acidity at 6 day		Acidity at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.000347	0.000940	0.000704	0.002221
V	1	0.009928	0.012063	5.13E-06	0.000288
T	12	0.006123	0.005522	0.004836	0.005688
V X T	12	0.0005	0.000485	0.000536	0.000813
Error	50	0.001635	0.001514	0.000744	0.001158
Total	77				

Source of variation	D. F.	M.S.S.	
		Acidity at 6 day	Acidity at 9 day
		Pooled	Pooled
REP	4	0.001164	0.004558
YEAR	1	0.002083	0.012385

V	1	0.021939	0.000108
T	12	0.011606	0.010395
V X T	12	0.000945	0.001304
Y XV X T	12	0.001912	0.000198
Error	117	0.001368	0.000863
Total	155		

Appendix -X

Analysis of variance for reducing sugars (%) during storage period

Source of variation	D. F.	M.S.S.			
		Reducing sugars at 0 day		Reducing sugars at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.002262	4.62E-05	0.018047	0.003958
V	1	0.031601	0.001851	0.063185	0.022001
T	12	3.100508	4.720161	3.120044	4.073463
V X T	12	0.014987	0.025962	0.015879	0.033982
Error	50	0.002063	0.002093	0.006113	0.005854
Total	77				

Source of variation	D. F.	M.S.S.	
		Reducing sugars at 0 day	Reducing sugars at 3 day
		Pooled	Pooled
REP	4	0.586398	0.634837
YEAR	1	2.340975	2.495339
V	1	0.024375	0.079878
T	12	7.616769	7.087608
V X T	12	0.024111	0.046285
Y XV X T	12	0.223526	0.116574
Error	117	0.001815	0.00549
Total	155		

Source of variation	D. F.	M.S.S.			
		Reducing sugars at 6 day		Reducing sugars at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.002909	0.006512	0.000471	0.002155
V	1	0.035328	0.000063	0.243713	0.396328
T	12	3.844888	4.919363	2.831302	3.409443
V X T	12	0.020098	0.034282	0.062629	0.092381
Error	50	0.013838	0.006672	0.000809	0.002847
Total	77				

Source of variation	D. F.	M.S.S.	
		Reducing sugars at 6 day	Reducing sugars at 9 day
		Pooled	Pooled
REP	4	0.336557	0.066136
YEAR	1	1.327385	0.259292

V	1	0.019185	0.63081
T	12	8.61241	6.152897
V X T	12	0.044152	0.13901
Y XV X T	12	0.165018	0.157185
Error	117	0.008926	0.001607
Total	155		

Appendix -XI

Analysis of variance for non reducing sugars (%) during storage period

Source of variation	D. F.	M.S.S.			
		Non reducing sugars at 0 day		Non reducing sugars at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.000694	0.009574	0.000574	0.040758
V	1	0.220801	0.075704	0.587601	0.447796
T	12	2.743687	2.519606	3.817188	3.015174
V X T	12	0.018137	0.015204	0.117087	0.173493
Error	50	0.000792	0.002237	0.000516	0.00744
Total	77				

Source of variation	D. F.	M.S.S.	
		Non reducing sugars at 0 day	Non reducing sugars at 3 day
		Pooled	Pooled
REP	4	0.044878	0.091322
YEAR	1	0.158977	0.282626
V	1	0.277541	1.030656
T	12	5.232976	6.759818
V X T	12	0.030067	0.253883
Y XV X T	12	0.0583	0.195525
Error	117	0.00147	0.004107
Total	155		

Source of variation	D. F.	M.S.S.			
		Non reducing sugars at 6 day		Non reducing sugars at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.062805	0.072467	0.000996	0.001662
V	1	1.537212	0.528415	0.371082	0.149078
T	12	3.233207	2.742810	3.518124	3.30954
V X T	12	0.068892	0.126435	0.100263	0.084459
Error	50	0.000256	0.028780	0.002501	0.002727
Total	77				

Source of variation	D. F.	M.S.S.	
		Non reducing sugars at 6 day	Non reducing sugars at 9 day
		Pooled	Pooled

REP	4	0.150151	0.22183
YEAR	1	0.455544	0.882006
V	1	1.934083	0.495283
T	12	5.954068	6.807269
V X T	12	0.184904	0.176491
Y XV X T	12	0.204507	0.071972
Error	117	0.013648	0.001607
Total	155		

Appendix -XII

Analysis of variance for total sugars (%) during storage period

Source of variation	D. F.	M.S.S.			
		Total sugars at 0 day		Total sugars at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.003097	0.001573	0.010758	0.004209
V	1	0.415078	0.078217	1.054678	0.259615
T	12	11.62436	13.73717	13.65129	14.01817
V X T	12	0.040287	0.014769	0.131839	0.155832
Error	50	0.002727	0.003766	0.002918	0.00583
Total	77				

Source of variation	D. F.	M.S.S.	
		Total sugars at 0 day	Total sugars at 3 day
		Pooled	Pooled
REP	4	0.325476	0.407041
YEAR	1	1.292564	1.598231
V	1	0.426831	1.180416
T	12	25.09537	27.42057
V X T	12	0.040028	0.232751
Y XV X T	12	0.322292	0.413333
Error	117	0.002855	0.003994
Total	155		

Source of variation	D. F.	M.S.S.			
		Total sugars at 6 day		Total sugars at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.005555	0.00226	0.000509	0.007117
V	1	2.367796	0.52513	0.009263	0.059815
T	12	12.67666	14.54540	12.91147	13.14813
V X T	12	0.065771	0.13145	0.219382	0.161843
Error	50	0.004086	0.00240	0.003197	0.002219
Total	77				

Source of variation	D. F.	M.S.S.	
		Total sugars at 6 day	Total sugars at 9 day
		Pooled	Pooled

REP	4	0.211812	0.024009
YEAR	1	0.831616	0.080785
V	1	2.561539	0.058078
T	12	27.02287	26.01692
V X T	12	0.178695	0.339839
Y XV X T	12	0.458792	0.089817
Error	117	0.002904	0.002445
Total	155		

Appendix -XIII

Analysis of variance for pectin (%) during storage period

Source of variation	D. F.	M.S.S.			
		Pectin at 0 day		Pectin at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.002112	0.004324	0.000594	0.000824
V	1	0.008621	0.0078	0.008412	0.006104
T	12	0.220171	0.237732	0.263874	0.282001
V X T	12	0.000571	0.000469	0.000739	0.000904
Error	50	0.001777	0.001494	0.001899	0.001426
Total	77				

Source of variation	D. F.	M.S.S.	
		Pectin at 0 day	Pectin at 3 day
		Pooled	Pooled
REP	4	0.004821	0.001735
YEAR	1	0.00641	0.004103
V	1	0.01641	0.014423
T	12	0.457651	0.545596
V X T	12	0.000971	0.001624
Y XV X T	12	0.001689	0.001507
Error	117	0.001508	0.001445
Total	155		

Source of variation	D. F.	M.S.S.			
		Pectin at 6 day		Pectin at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.00679	0.00463	0.002692	0.00224
V	1	0.002051	0.00308	0.007601	0.007601
T	12	0.306461	0.33169	0.362579	0.396625
V X T	12	0.001062	0.00114	0.001521	0.001571
Error	50	0.002986	0.00293	0.00214	0.00181
Total	77				

Source of variation	D. F.	M.S.S.	
		Pectin at 6 day	Pectin at 9 day
		Pooled	Pooled

REP	4	0.006518	0.002805
YEAR	1	0.003231	0.001356
V	1	0.005078	0.015203
T	12	0.63766	0.758668
V X T	12	0.00211	0.003054
Y XV X T	12	0.001014	0.00184
Error	117	0.002721	0.001773
Total	155		

Appendix -XIV

Analysis of variance for appearance during storage period

Source of variation	D. F.	M.S.S.			
		Appearance at 0 day		Appearance at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.005412	0.000824	0.008467	0.000217
V	1	0.193005	0.080771	1.216251	0.657251
T	12	2.705465	2.752612	4.906637	4.793466
V X T	12	0.020625	0.065918	0.125557	0.307699
Error	50	0.011262	0.000983	0.003177	0.002145
Total	77				

Source of variation	D. F.	M.S.S.	
		Appearance at 0 day	Appearance at 3 day
		Pooled	Pooled
REP	4	0.012272	0.005758
YEAR	1	0.036616	0.005664
V	1	0.261744	1.830833
T	12	5.417459	9.639436
V X T	12	0.060964	0.383294
Y XV X T	12	0.089012	0.266753
Error	117	0.00534	0.002423
Total	155		

Source of variation	D. F.	M.S.S.			
		Appearance at 6 day		Appearance at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.01185	0.00239	0.007988	0.001855
V	1	0.316678	0.04776	0.072012	0.005755
T	12	6.198107	6.04088	9.947246	9.569475
V X T	12	0.361837	0.58029	0.029181	0.074375
Error	50	0.007101	0.00073	0.005672	0.000835
Total	77				

Source of variation	D. F.	M.S.S.	
		Appearance at 6 day	Appearance at 9 day
		Pooled	Pooled

REP	4	0.007661	0.005847
YEAR	1	0.002156	0.003703
V	1	0.305192	0.059241
T	12	12.15924	19.47785
V X T	12	0.854402	0.062062
Y XV X T	12	0.197842	0.086848
Error	117	0.003592	0.002949
Total	155		

Appendix -XV

Analysis of variance for taste during storage period

Source of variation	D. F.	M.S.S.			
		Taste at 0 day		Taste at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.017913	0.000463	0.008624	0.000627
V	1	0.166154	0.099082	0.020032	0.352021
T	12	0.900684	0.976445	0.902418	1.359713
V X T	12	0.037034	0.048321	0.027401	0.164304
Error	50	0.027791	0.001209	0.004691	0.001254
Total	77				

Source of variation	D. F.	M.S.S.	
		Taste at 0 day	Taste at 3 day
		Pooled	Pooled
REP	4	0.049252	0.013476
YEAR	1	0.160256	0.035401
V	1	0.260926	0.809495
T	12	1.868085	1.674519
V X T	12	0.070355	0.067483
Y XV X T	12	0.046147	2.420451
Error	117	0.012708	0.002699
Total	155		

Source of variation	D. F.	M.S.S.			
		Taste at 6 day		Taste at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.005619	0.00308	0.003586	0.002104
V	1	0.228313	0.55508	0.866262	0.902463
T	12	5.832993	6.87150	11.9455	12.48839
V X T	12	0.09266	0.21720	0.360409	0.354077
Error	50	0.002573	0.00124	0.003151	0.000853
Total	77				

Source of variation	D. F.	M.S.S.	
		Taste at 6 day	Taste at 9 day
		Pooled	Pooled

REP	4	0.054965	0.008814
YEAR	1	0.202464	0.023878
V	1	0.747692	1.768539
T	12	12.61728	24.4194
V X T	12	0.250185	0.713142
Y XV X T	12	0.212172	0.163223
Error	117	0.001777	0.001809
Total	155		

Appendix -XVI

Analysis of variance for flavour during storage period

Source of variation	D. F.	M.S.S.			
		Flavour at 0 day		Flavour at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.00515	0.004594	0.013619	0.000754
V	1	0.083365	0.127212	0.062051	0.380801
T	12	2.699129	2.689753	4.225629	5.05626
V X T	12	0.433524	0.434303	0.162235	0.34101
Error	50	0.002785	0.002519	0.00239	0.001111
Total	77				

Source of variation	D. F.	M.S.S.	
		Flavour at 0 day	Flavour at 3 day
		Pooled	Pooled
REP	4	0.039672	0.01913
YEAR	1	0.139203	0.047775
V	1	0.208269	0.375144
T	12	5.387029	9.21648
V X T	12	0.865423	0.44739
Y XV X T	12	0.021806	0.158168
Error	117	0.002433	0.001742
Total	155		

Source of variation	D. F.	M.S.S.			
		Flavour at 6 day		Flavour at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.000805	0.00652	0.003563	0.000188
V	1	2.336538	2.53080	2.640032	3.601251
T	12	2.711287	3.51322	4.845451	5.41922
V X T	12	0.278569	0.30652	0.057149	0.126276
Error	50	0.003106	0.00818	0.003095	0.001027
Total	77				

Source of variation	D. F.	M.S.S.	
		Flavour at 6 day	Flavour at 9 day
		Pooled	Pooled

REP	4	0.006761	0.011495
YEAR	1	0.012385	0.038478
V	1	4.865401	6.204052
T	12	6.146309	10.23106
V X T	12	0.56437	0.163662
Y XV X T	12	0.504522	0.57348
Error	117	0.00495	0.001826
Total	155		

Appendix -XVII

Analysis of variance for texture during storage period

Source of variation	D. F.	M.S.S.			
		Texture at 0 day		Texture at 3 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.117062	0.001217	0.000814	0.000842
V	1	4.279396	3.452412	5.168283	4.449704
T	12	2.13091	2.313559	2.585699	2.759328
V X T	12	0.124974	0.101037	0.189773	0.099921
Error	50	0.009928	0.001297	0.00431	0.00203
Total	77				

Source of variation	D. F.	M.S.S.	
		Texture at 0 day	Texture at 3 day
		Pooled	Pooled
REP	4	0.119949	0.012407
YEAR	1	0.243241	0.046316
V	1	7.709631	9.604547
T	12	4.438082	5.326285
V X T	12	0.22056	0.261773
Y XV X T	12	0.656155	0.848162
Error	117	0.006819	0.002738
Total	155		

Source of variation	D. F.	M.S.S.			
		Texture at 6 day		Texture at 9 day	
		2015-16	2016-17	2015-16	2016-17
REP	2	0.009497	0.000804	0.0014	0.000927
V	1	5.257212	4.777988	0.337396	0.432771
T	12	3.902762	4.086485	6.57058	7.048601
V X T	12	0.242662	0.288594	0.085971	0.085996
Error	50	0.005452	0.001178	0.006464	0.001164
Total	77				

Source of variation	D. F.	M.S.S.	
		Texture at 6 day	Texture at 9 day
		Pooled	Pooled

REP	4	0.017226	0.002294
YEAR	1	0.048301	0.004523
V	1	10.02947	0.767203
T	12	7.986083	13.60889
V X T	12	0.523506	0.159897
Y XV X T	12	0.84718	0.08654
Error	117	0.003009	0.0033
Total	155		

VITA

The author of this manuscript has joined as Assistant Professor/Scientist at KNK College of Horticulture Mandsaur under JNKVV, Jabalpur (M.P.) since 29 Dec. 2004 which now comes under RVSKVV, Gwalior from August 2008. He took admission in Ph.D. (Horticulture) Fruit Science as In-Service candidate in RajmataVijayaraje Scindia Krishi Vishwa Vidyalaya, Department of Horticulture, College of Agriculture, Gwalior for the specialization in Fruit Science and in partia l fulfillment of the requirements for the award of the same he was allotted the interesting problem entitled **Effect of Pre-harvest Spray of GA_3 Calcium Nitrate and Potassium Sulphate on Post-harvest Behaviour of Guava (*Psidium guajava* L.) Fruits of Cultivars Dharidar and Chittidar** for his research work.

Place: **Gwalior**

Date: ……

(**Roop Narayan Kanpure**)

Ph. D. Scholar
Department of Horticulture
College of Agriculture,
Gwalior (M. P.) 474002

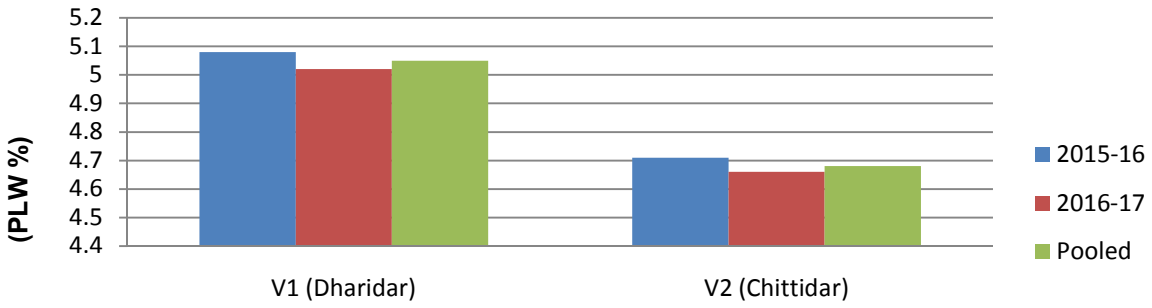

Fig. 4.1 Performance of varieties against physiological loss in weight (PLW %) at 3 day storage

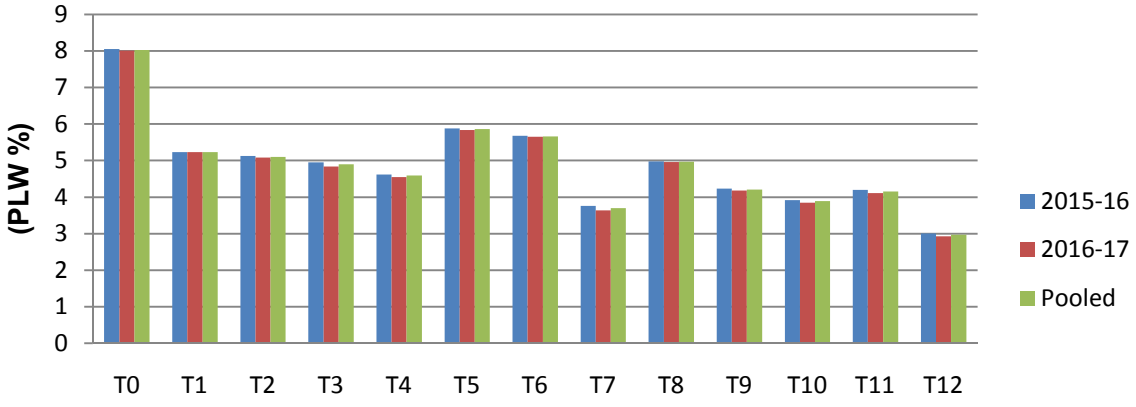

Fig. 4.2 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on physiological loss in weight (PLW %) at 3 day storage

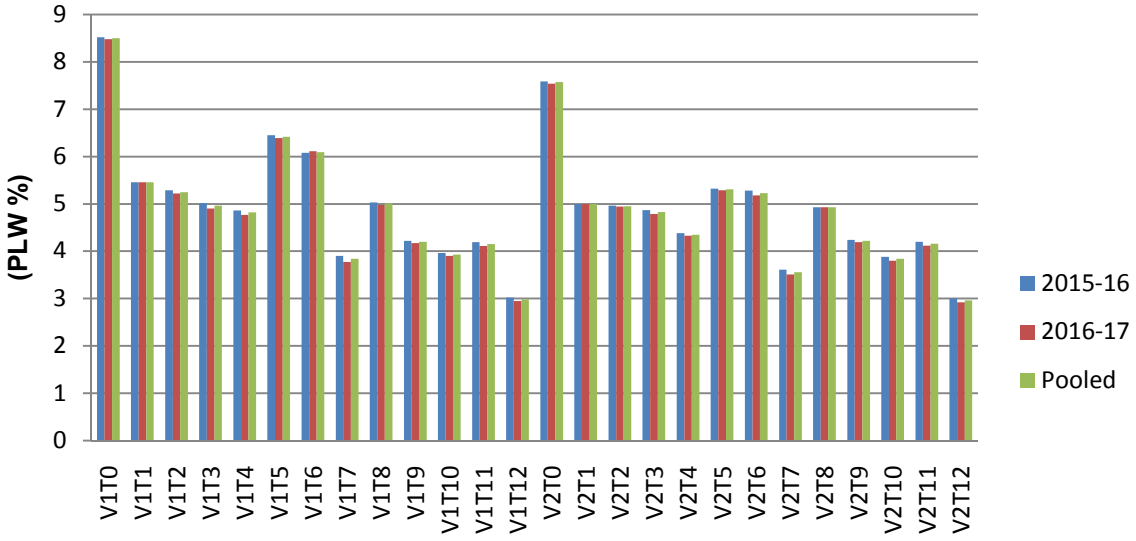

Fig. 4.3 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on physiological loss in weight (PLW %) at 3 day storage

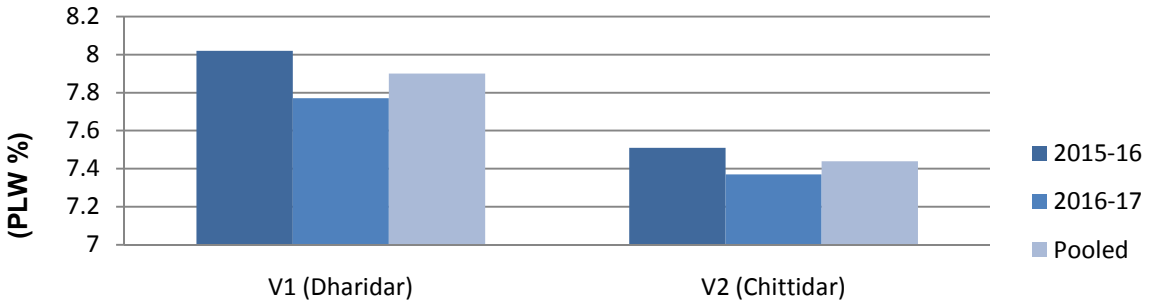

Fig. 4.4 Performance of varieties against physiological loss in weight (PLW %) at 6 day storage

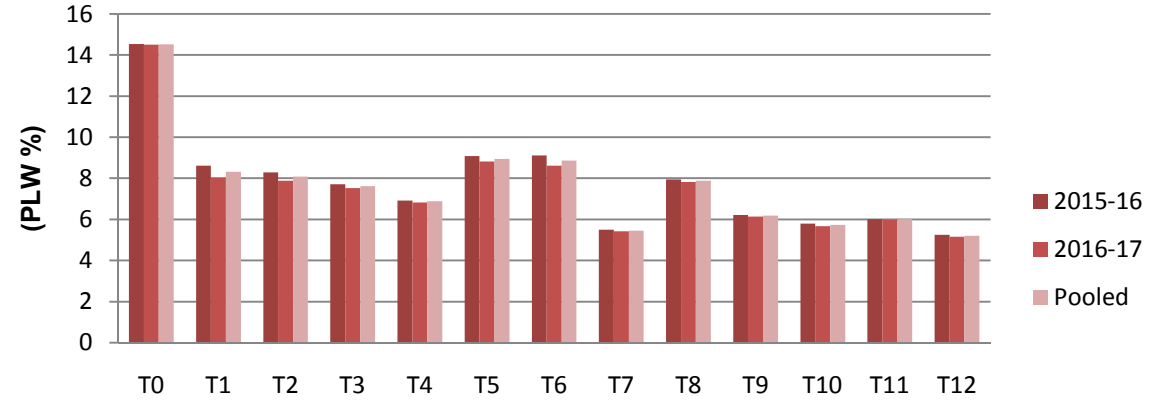

Fig. 4.5 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on physiological loss in weight (PLW %) at 6 day storage

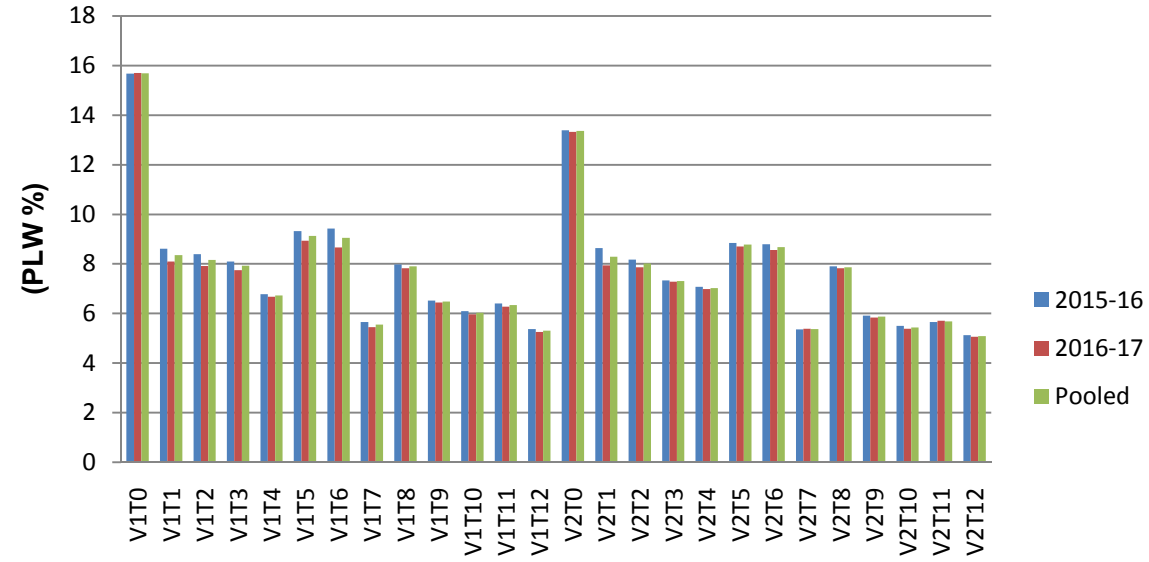

Fig. 4.6 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on physiological loss in weight (PLW %) at 6 day storage

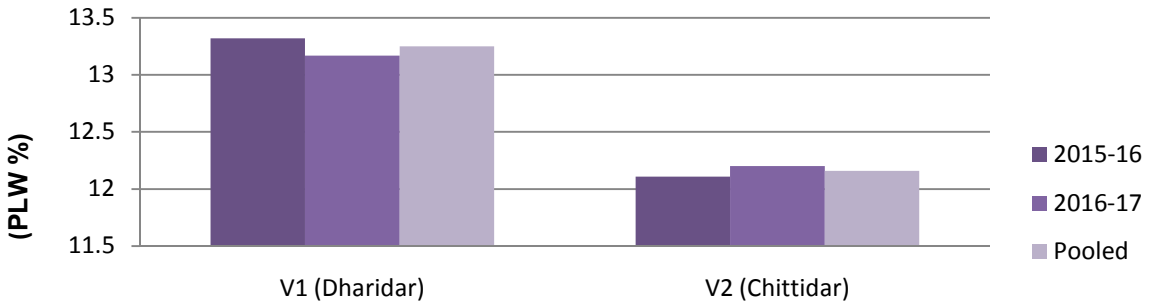

Fig. 4.7 Performance of varieties against physiological loss in weight (PLW %) at 9 day storage

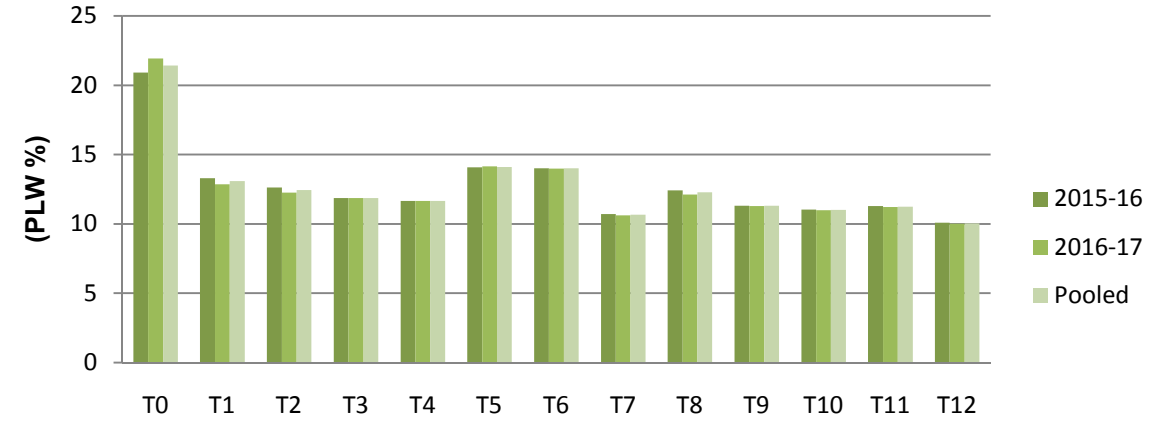

Fig. 4.8 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on physiological loss in weight (PLW %) at 9 day storage

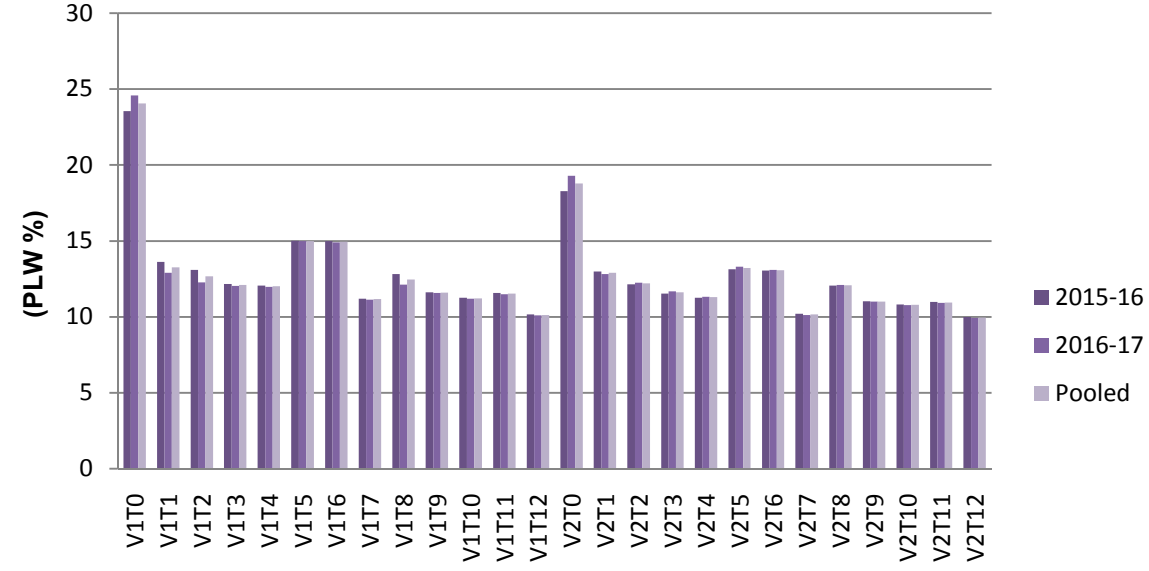

Fig. 4.9 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on physiological loss in weight (PLW %) at 9 day storage

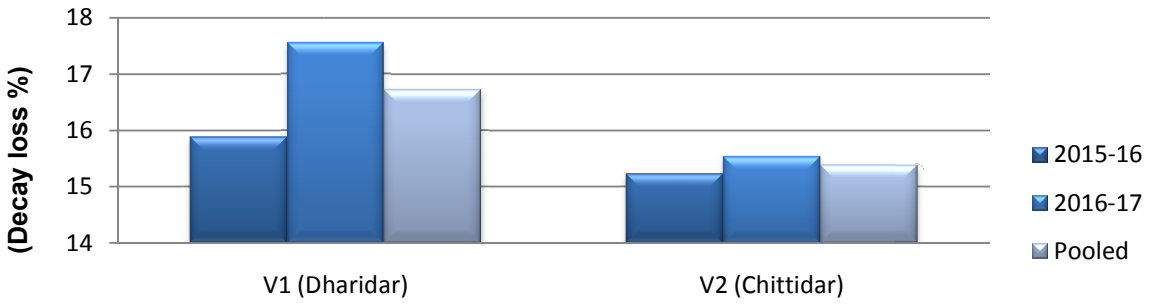

Fig. 4.10 Performance of varieties against decay loss % at 6 day storage

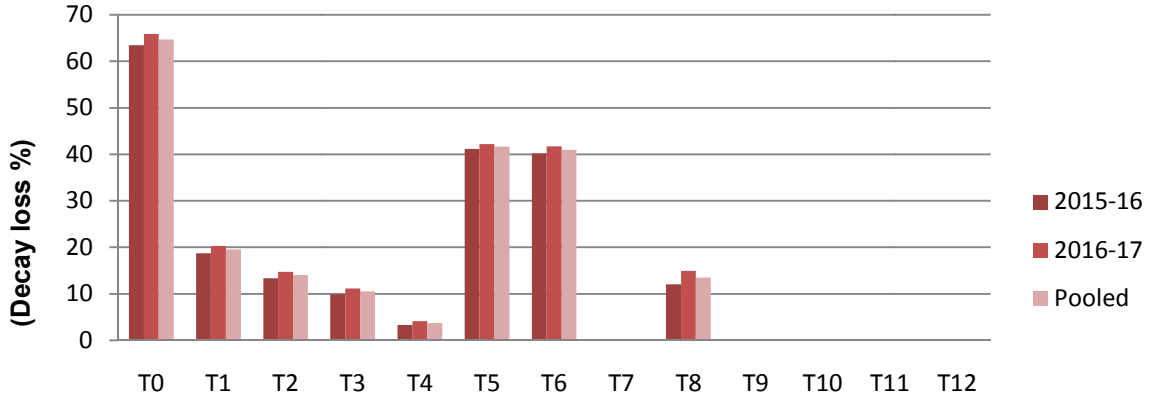

Fig. 4.11 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on decay loss % at 6 day storage

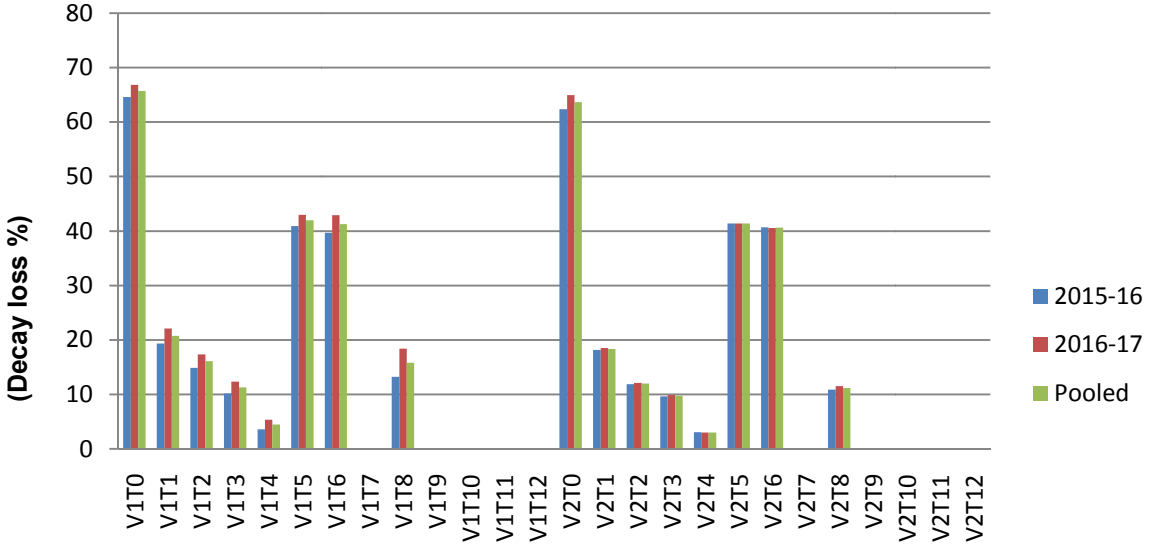

Fig. 4.12 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on decay loss % at 6 day storage

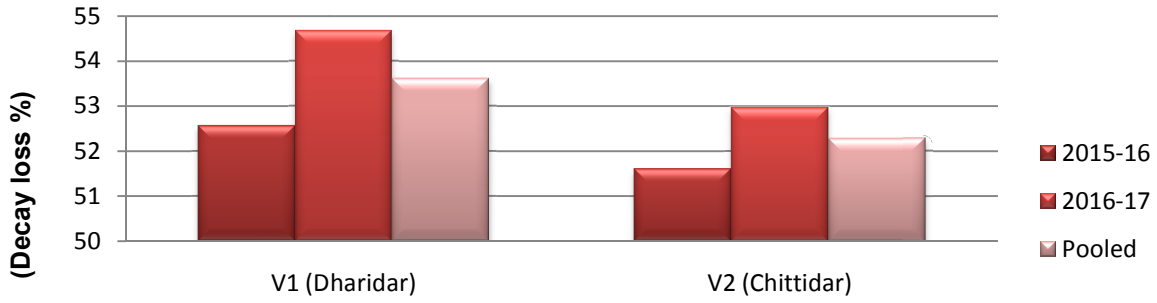

Fig. 4.13 Performance of varieties against decay loss % at 9 day storage

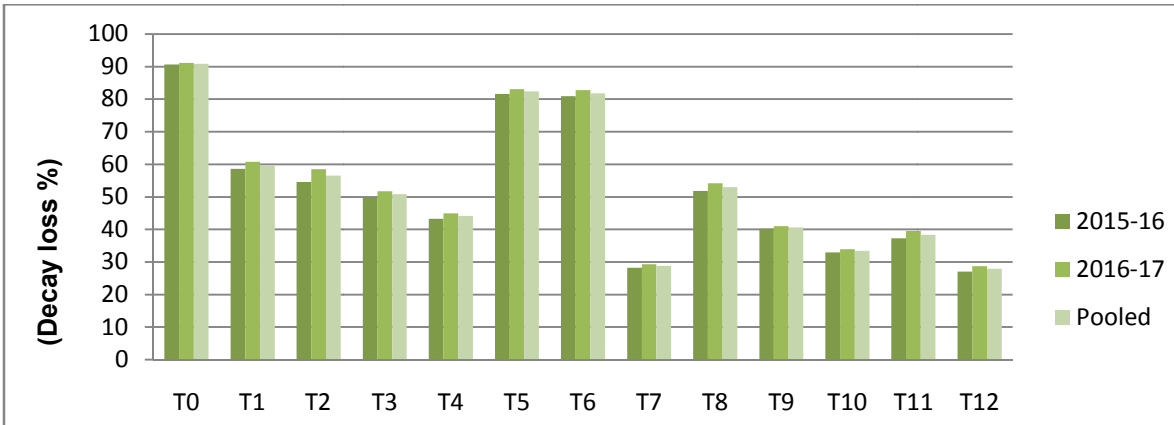

Fig. 4.14 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on decay loss % at 9 day storage

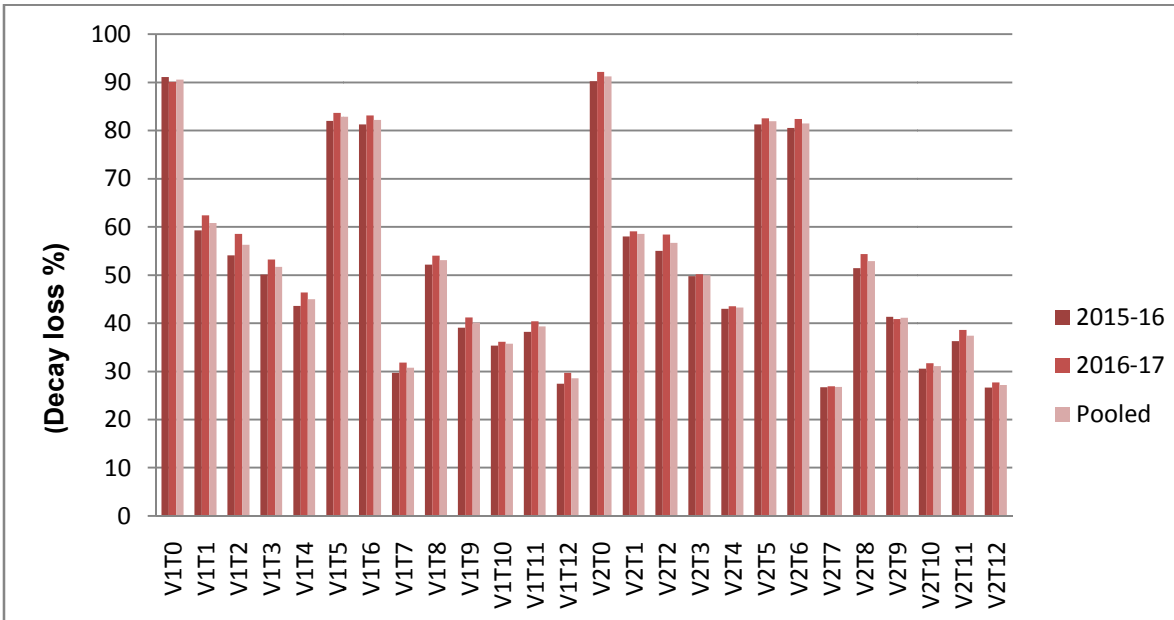

Fig. 4.15 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on decay loss % at 9 day storage

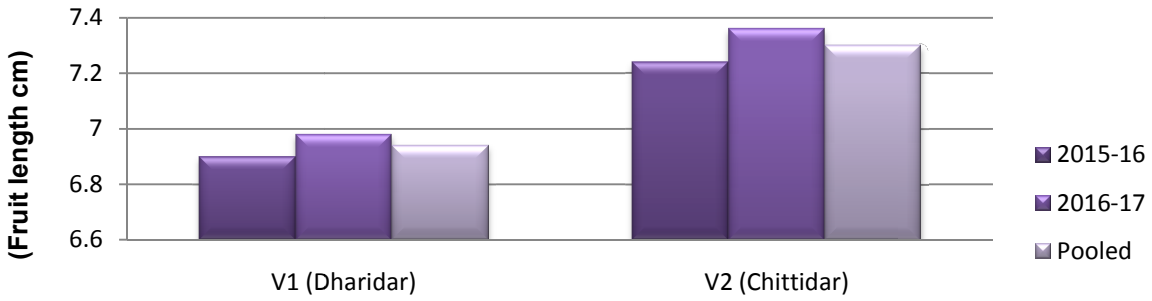

Fig. 4.16 Performance of varieties against fruit length (cm) at 0 day storage

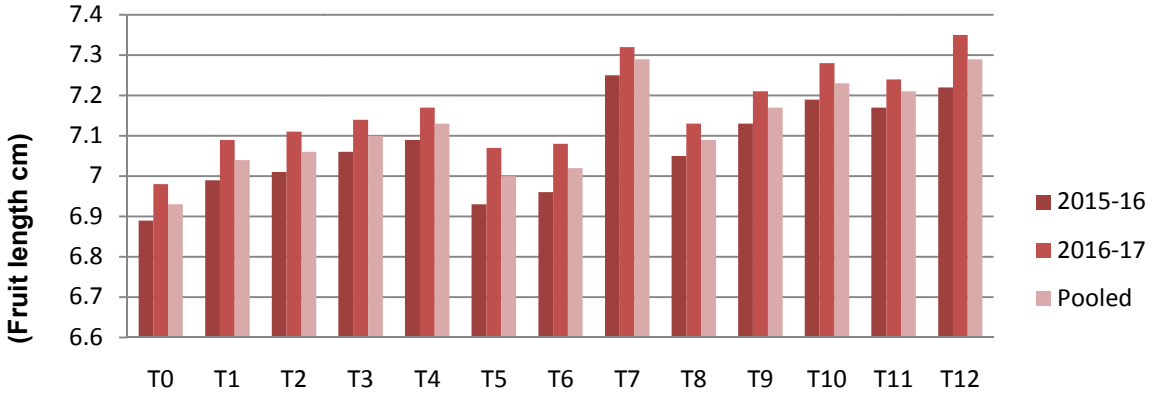

Fig. 4.17 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit length (cm) at 0 day storage

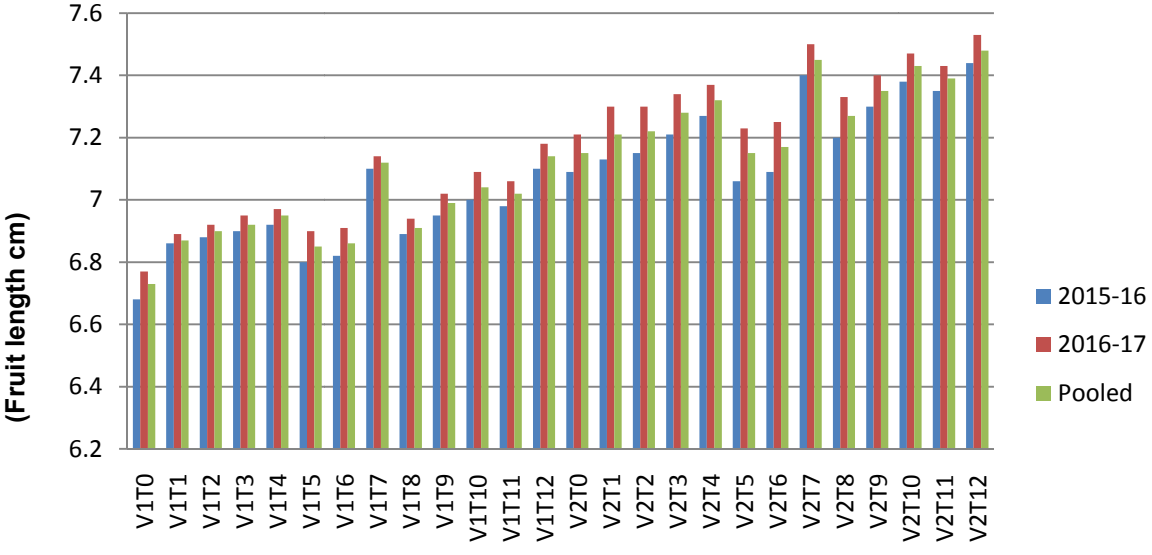

Fig. 4.18 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit length (cm) at 0 day storage

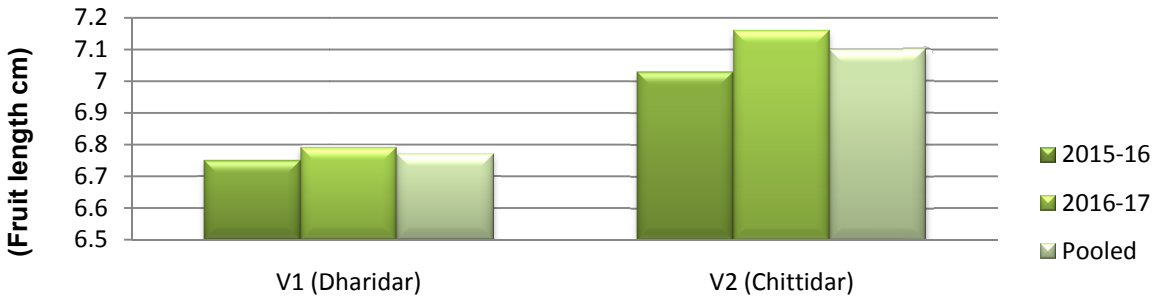

Fig. 4.19 Performance of varieties against fruit length (cm) at 3 day storage

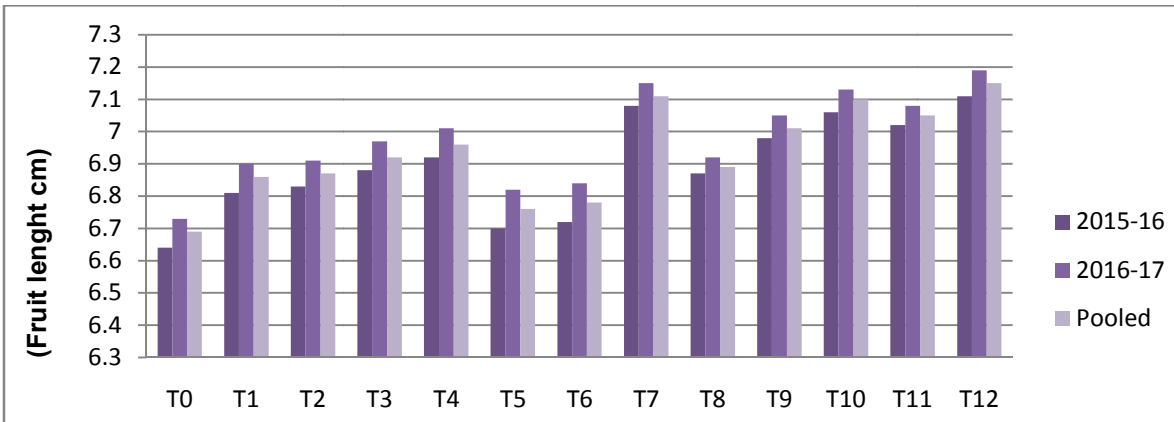

Fig. 4.20 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit length (cm) at 3 day storage

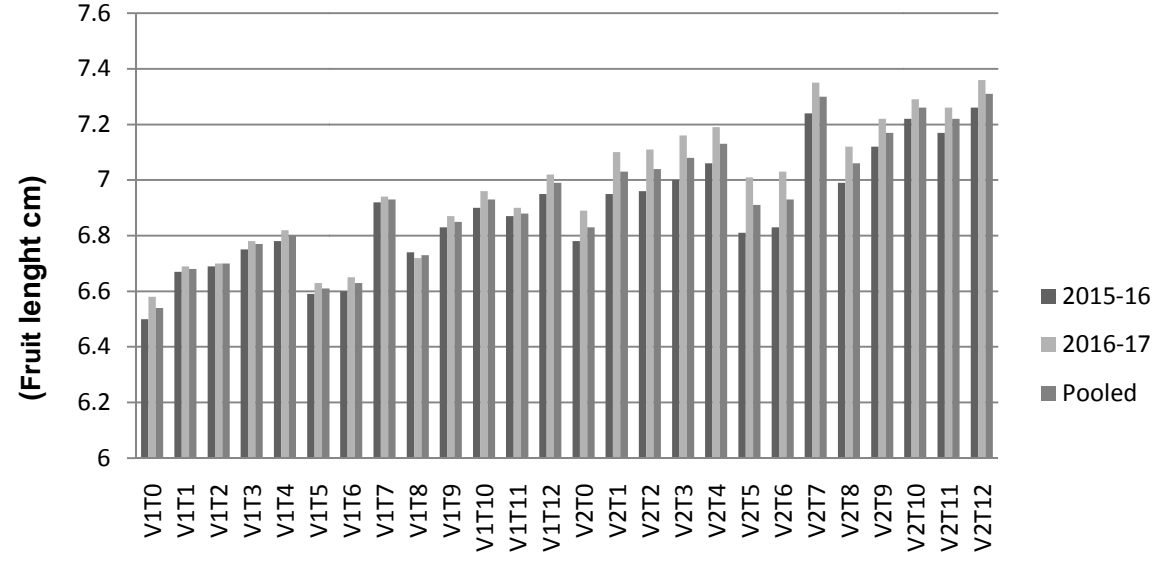

Fig. 4.21 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit length (cm) at 3 day storage

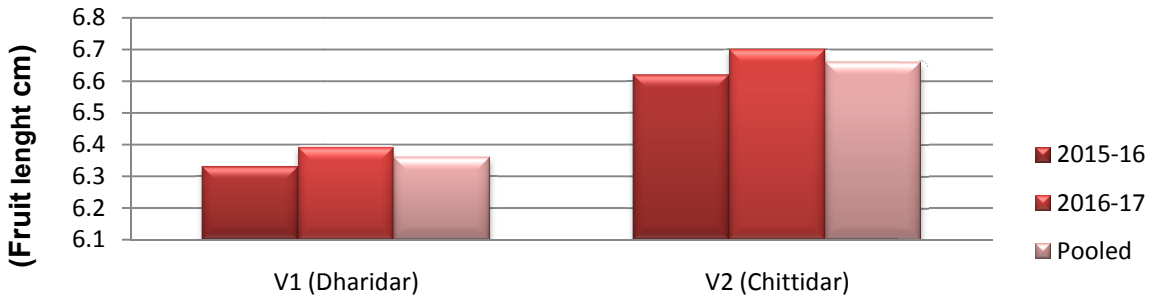

Fig. 4.22 Performance of varieties against fruit length (cm) at 6 day storage

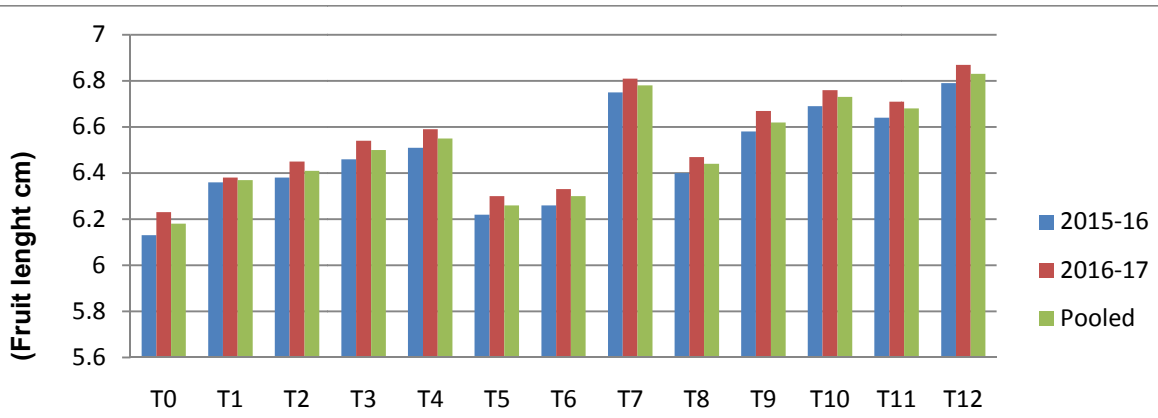

Fig. 4.23 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit length (cm) at 6 day storage

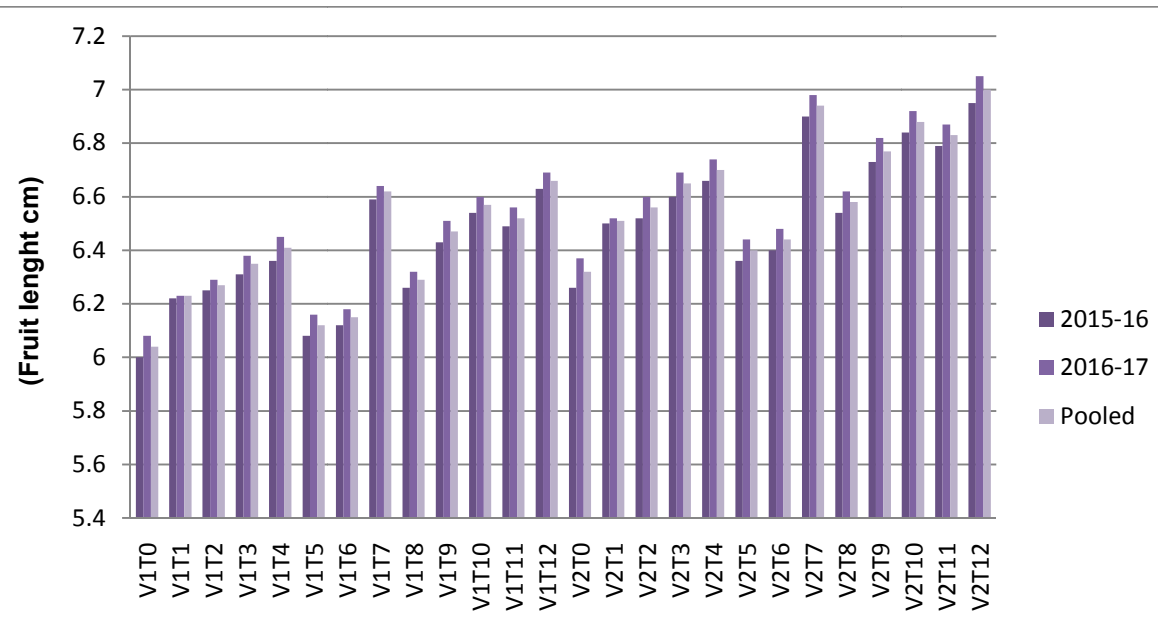

Fig. 4.24 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit length (cm) at 6 day storage

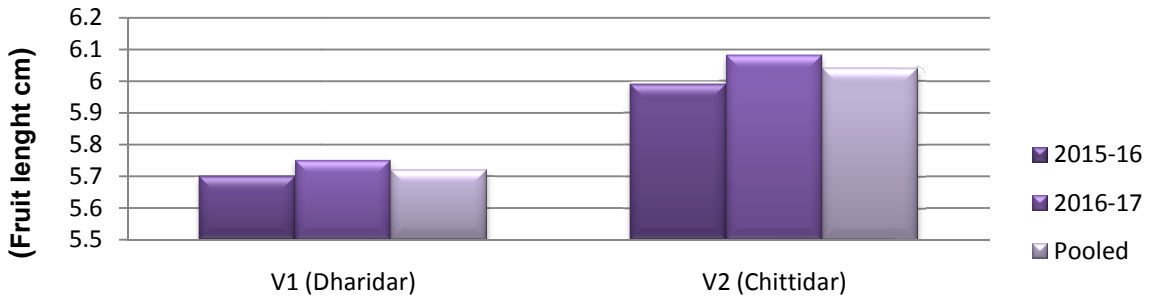

Fig. 4.25 Performance of varieties against fruit length (cm) at 9 day storage

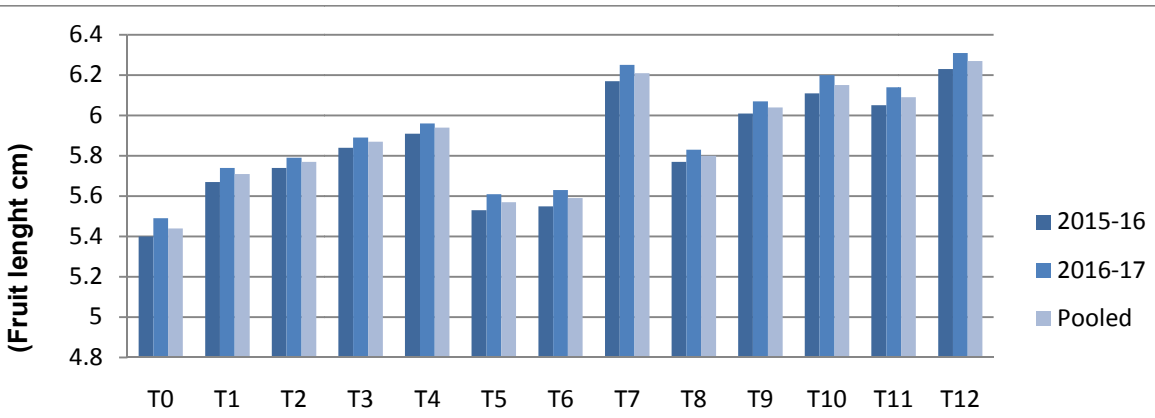

Fig. 4.26 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit length (cm) at 9 day storage

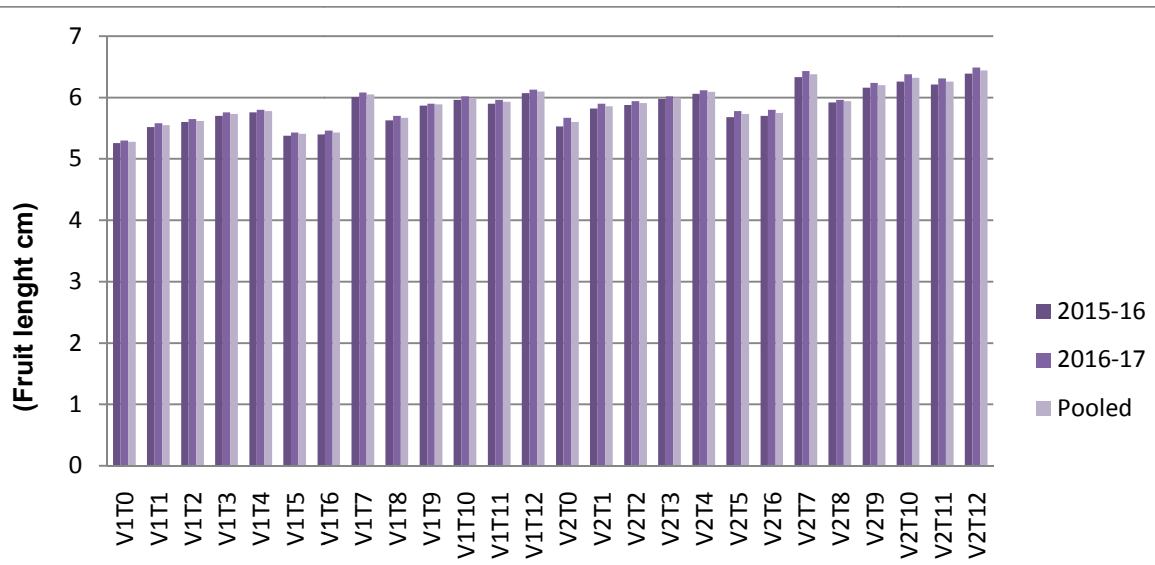

Fig. 4.27 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit length (cm) at 9 day storage

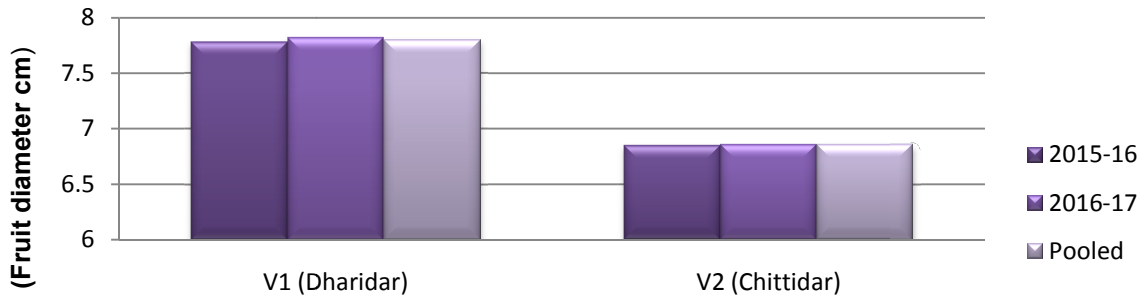

Fig. 4.28 Performance of varieties against fruit diameter (cm) at 0 day storage

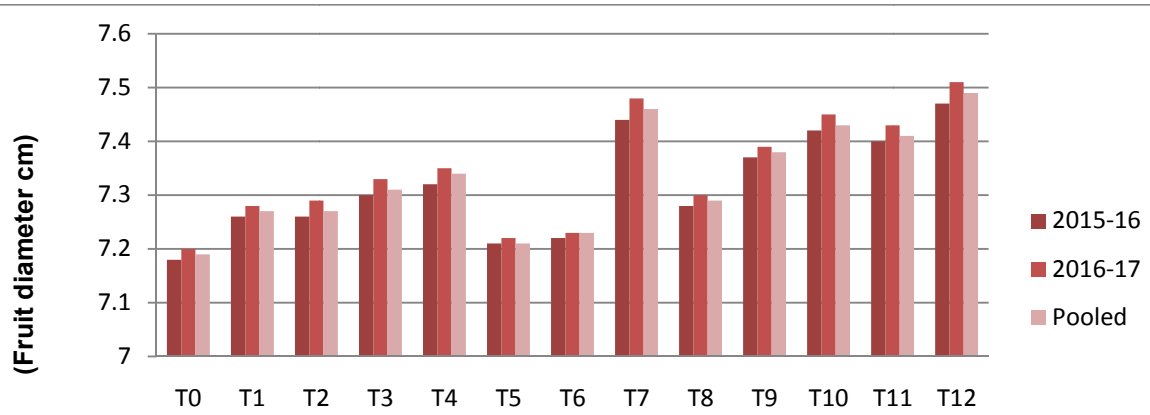

Fig. 4.29 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit diameter (cm) at 0 day storage

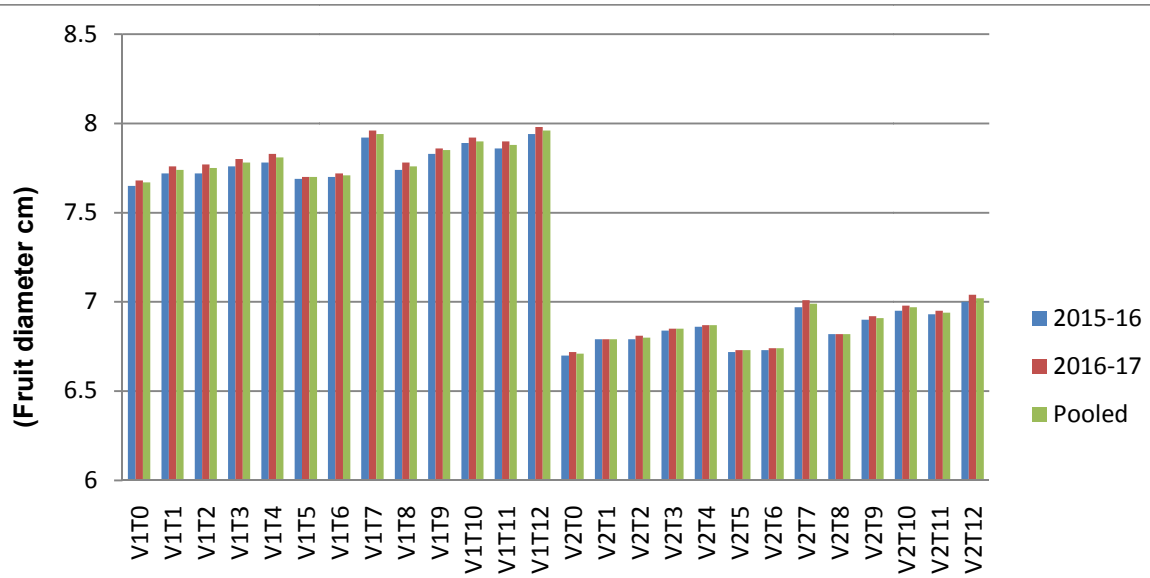

Fig. 4.30 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit diameter (cm) at 0 day storage

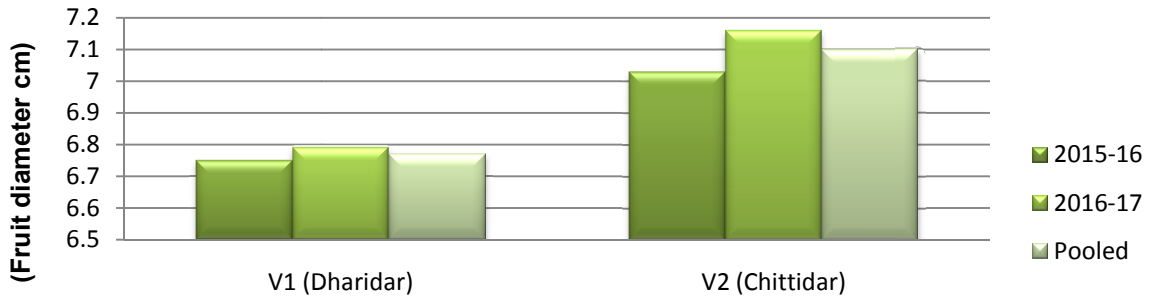

Fig. 4.31 Performance of varieties against fruit diameter (cm) at 3 days storage

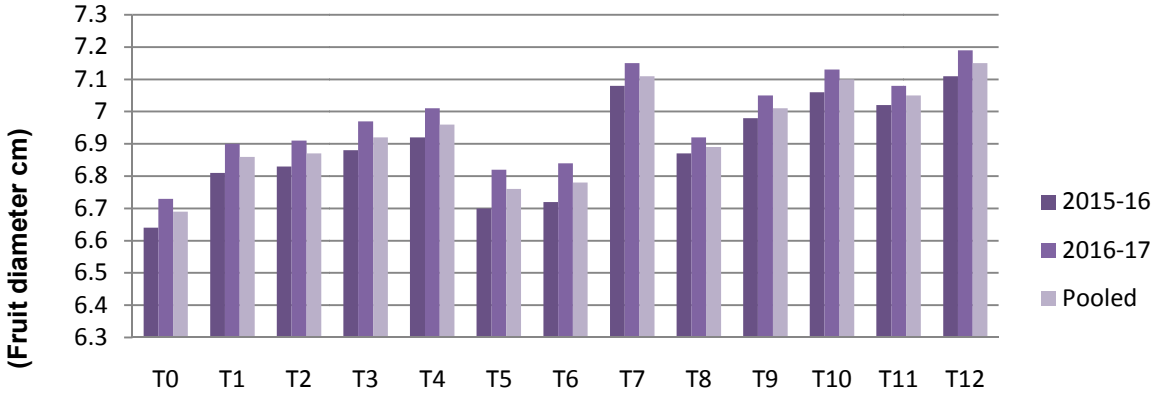

Fig. 4.32 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit diameter (cm) at 3 day storage

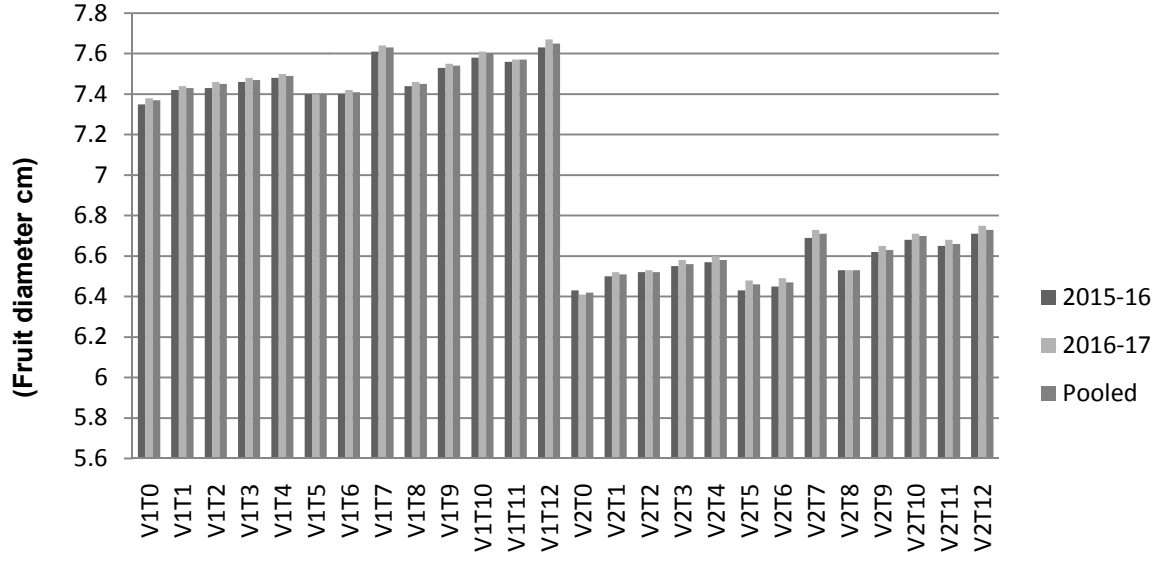

Fig. 4.33 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit diameter (cm) at 3 day storage

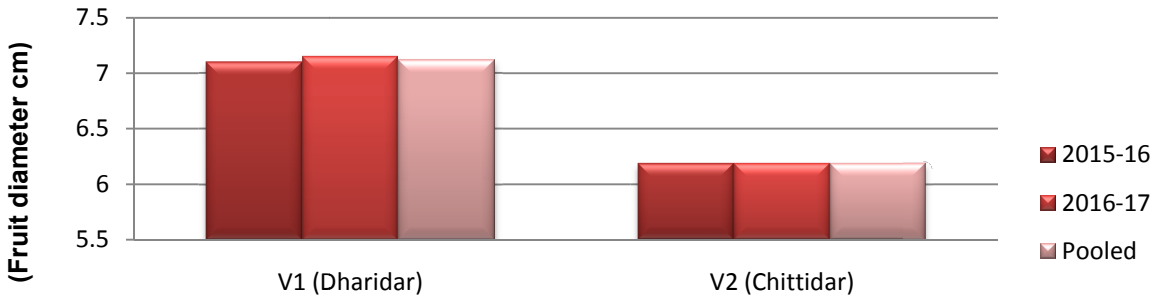

Fig. 4.34 Performance of varieties against fruit diameter (cm) at 6 day storage

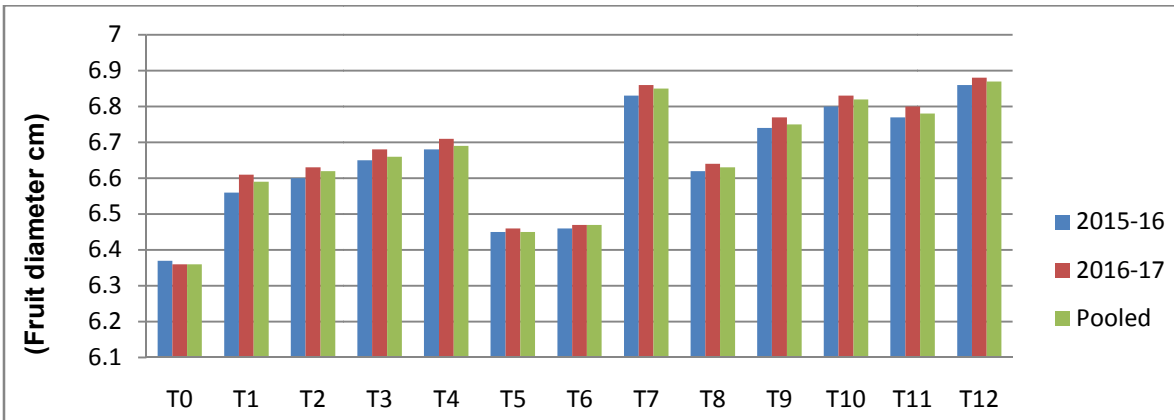

Fig. 4.35 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit diameter (cm) at 6 day storage

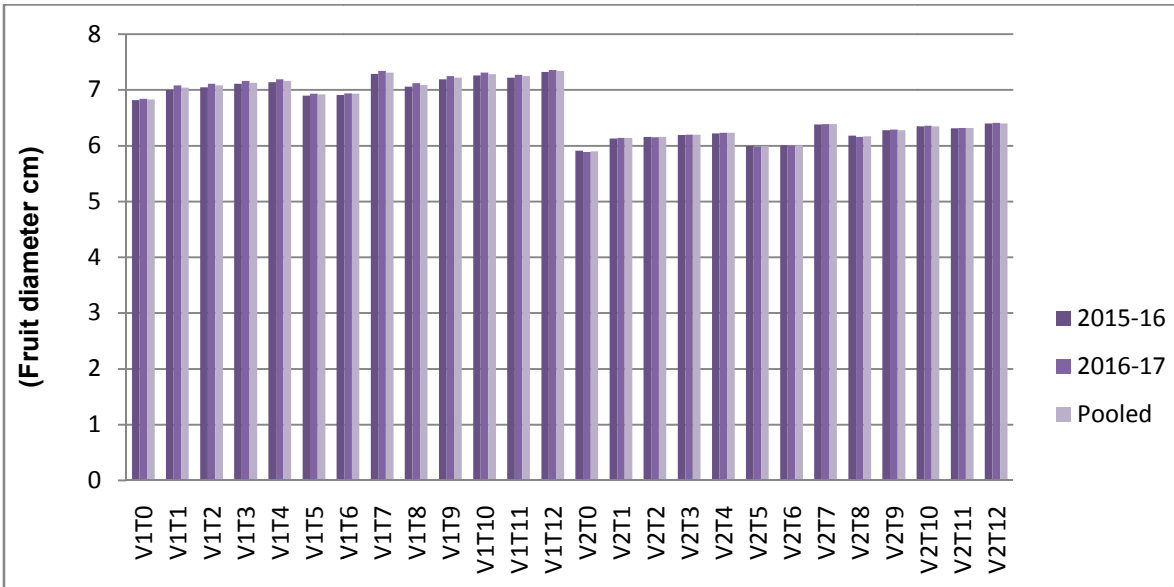

Fig. 4.36 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit diameter (cm) at 6 day storage

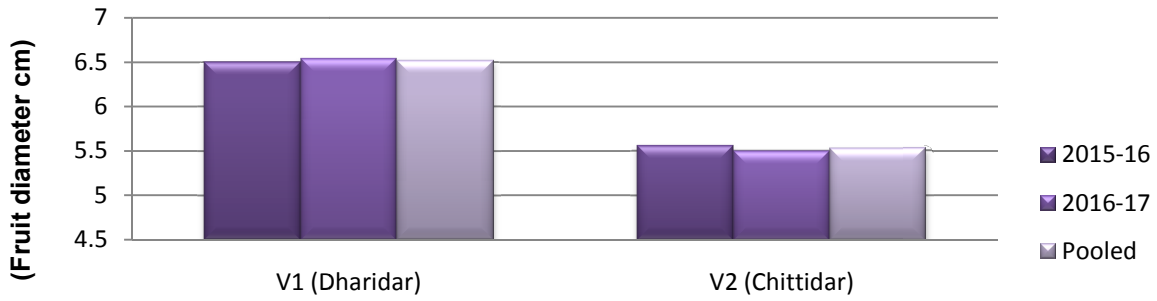

Fig. 4.37 Performance of varieties against fruit diameter (cm) at 9 day storage

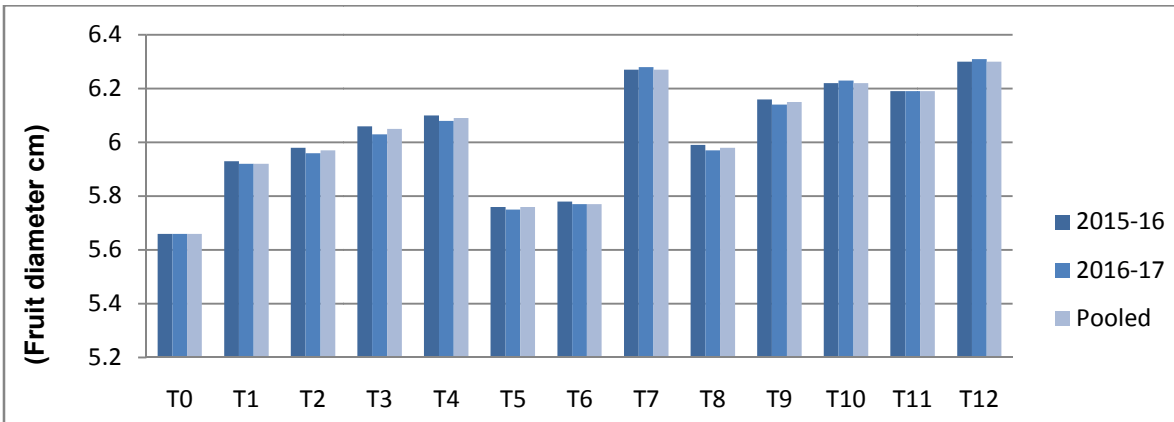

Fig. 4.38 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit diameter (cm) at 9 day storage

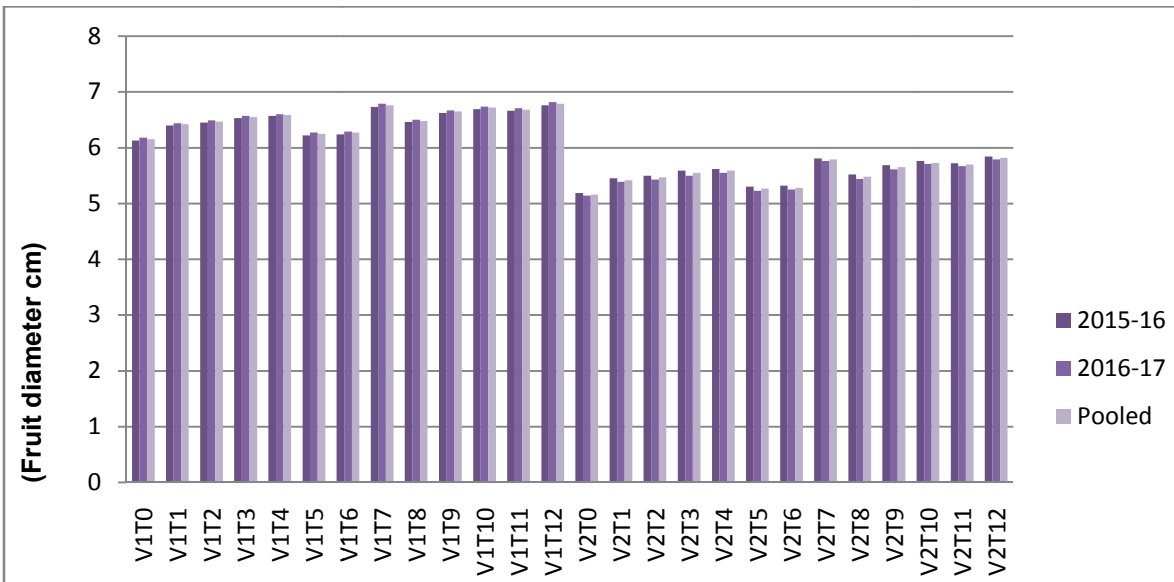

Fig. 4.39 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on fruit diameter (cm) at 9 day storage

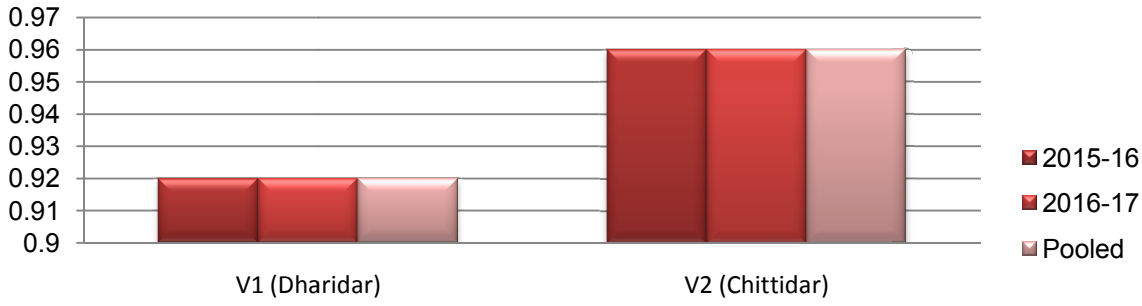

Fig. 4.40 Performance of varieties against specific gravity at 0 day storage

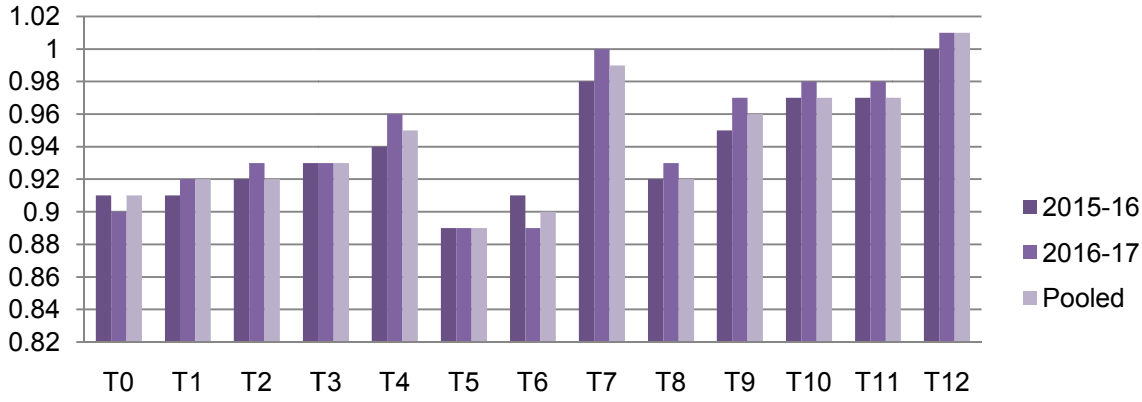

Fig. 4.41 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on specific gravity at 0 day storage

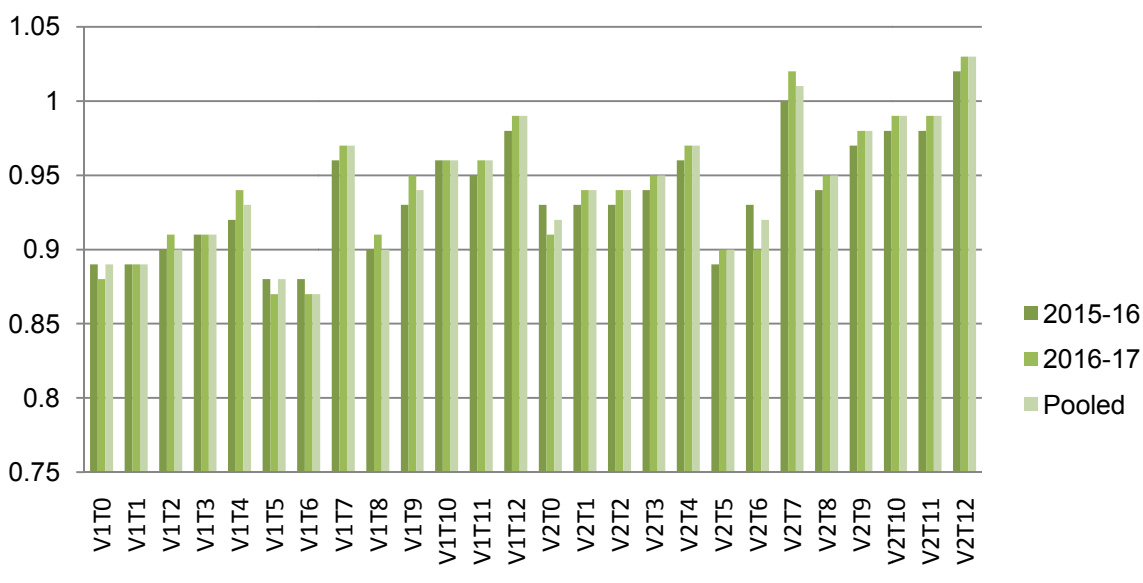

Fig. 4.42 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on specific gravity at 0 day storage

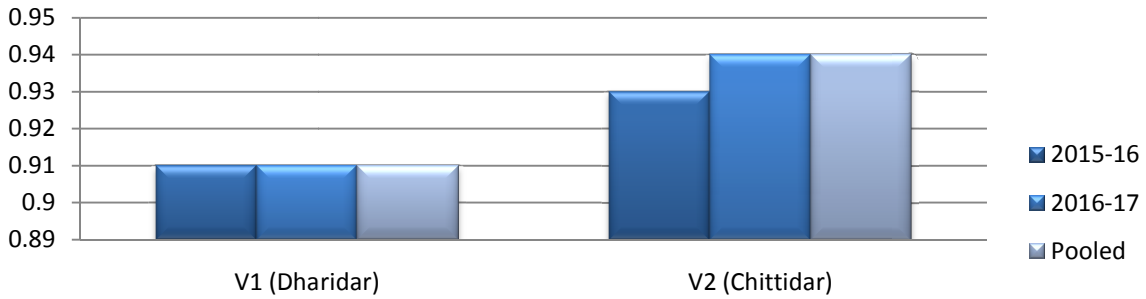

Fig. 4.43 Performance of varieties against specific gravity at 3 day storage

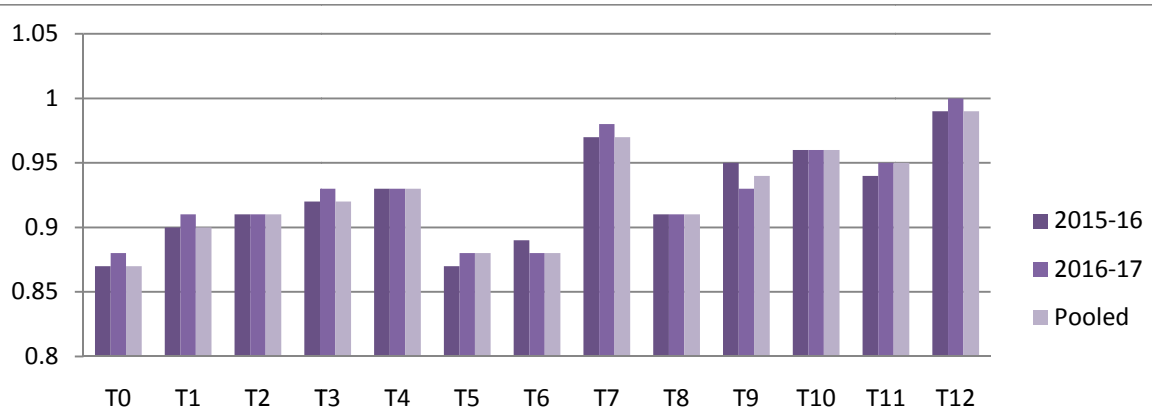

Fig. 4.44 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on specific gravity at 3 day storage

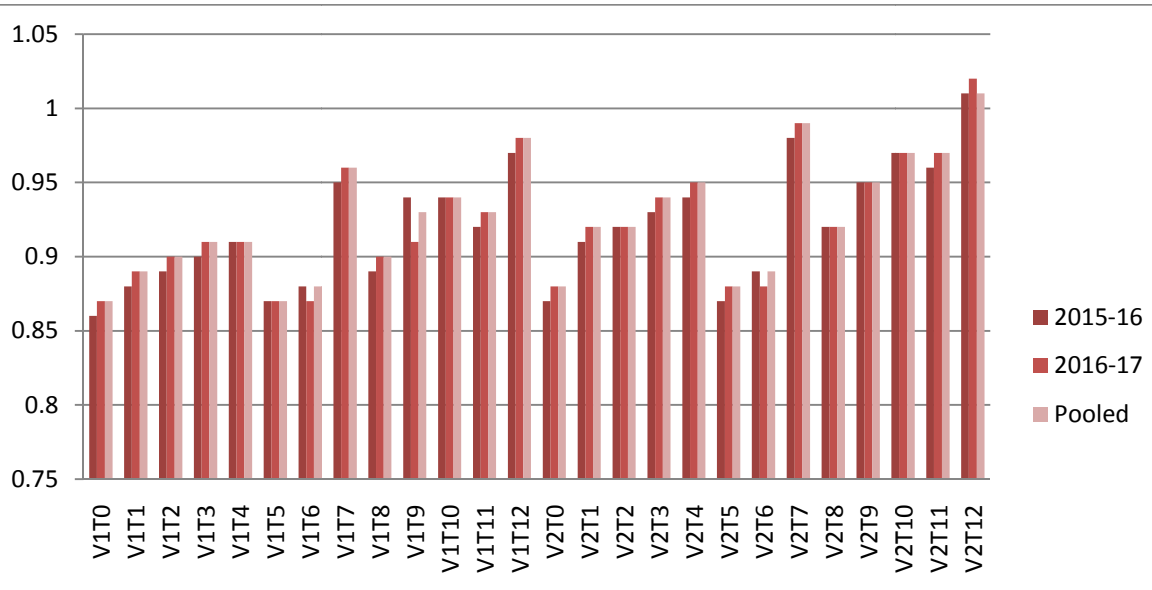

Fig. 4.45 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on specific gravity at 3 day storage

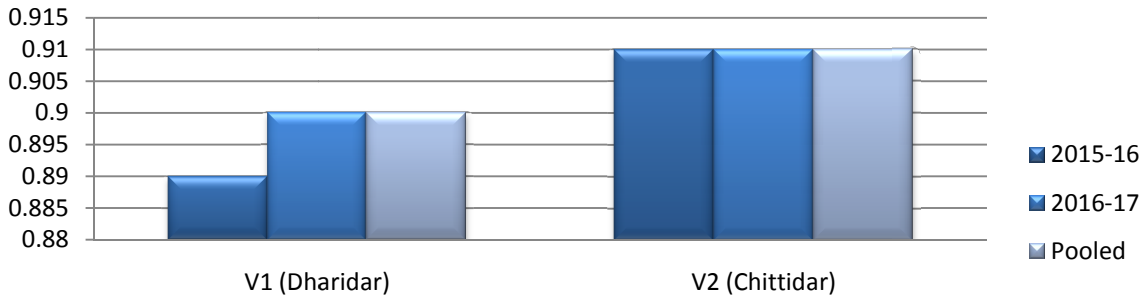

Fig. 4.46 Performance of varieties against fruit diameter (cm) at 6 day storage

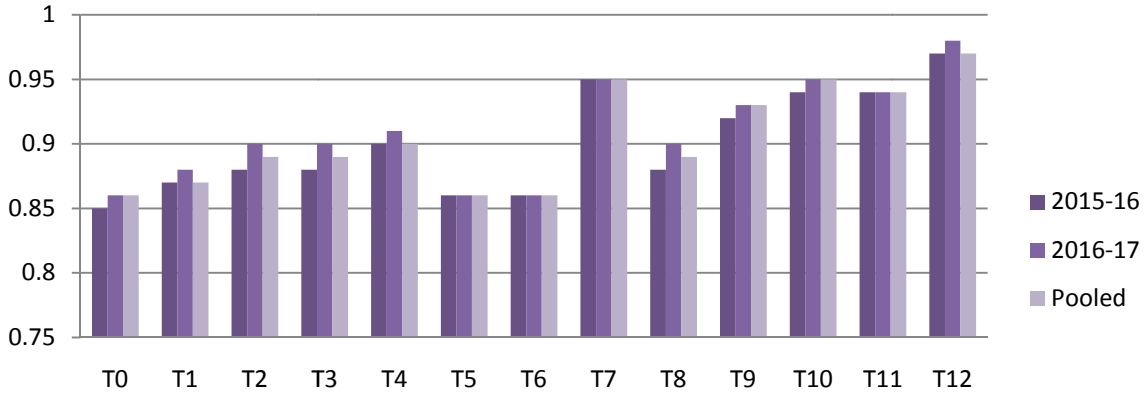

Fig. 4.47 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on specific gravity at 6 day storage

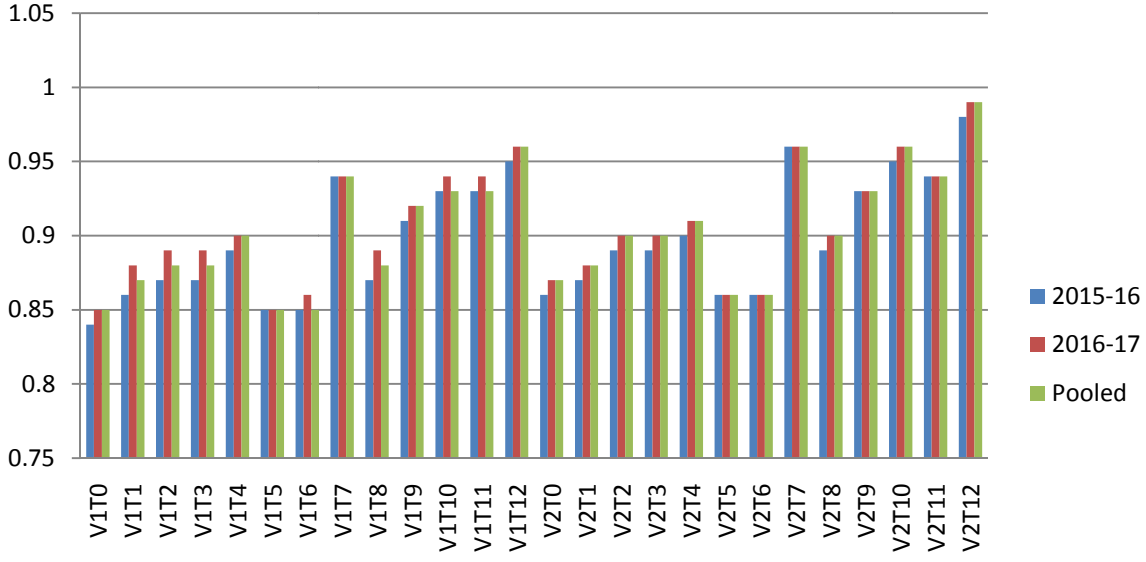

Fig. 4.48 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on specific gravity at 6 day storage

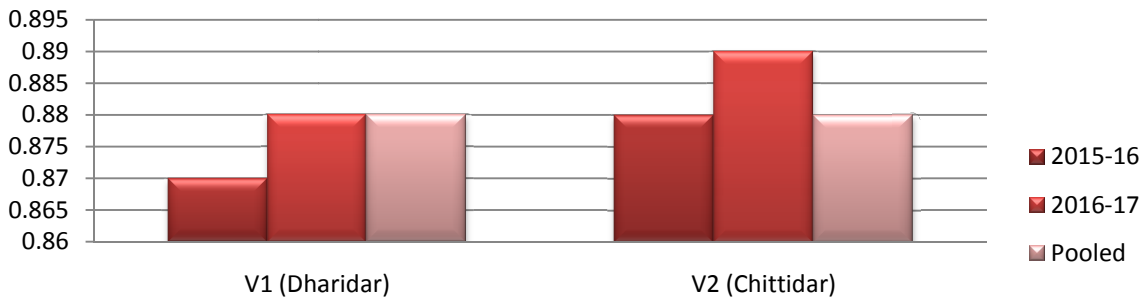

Fig. 4.49 Performance of varieties against specific gravity at 9 day storage

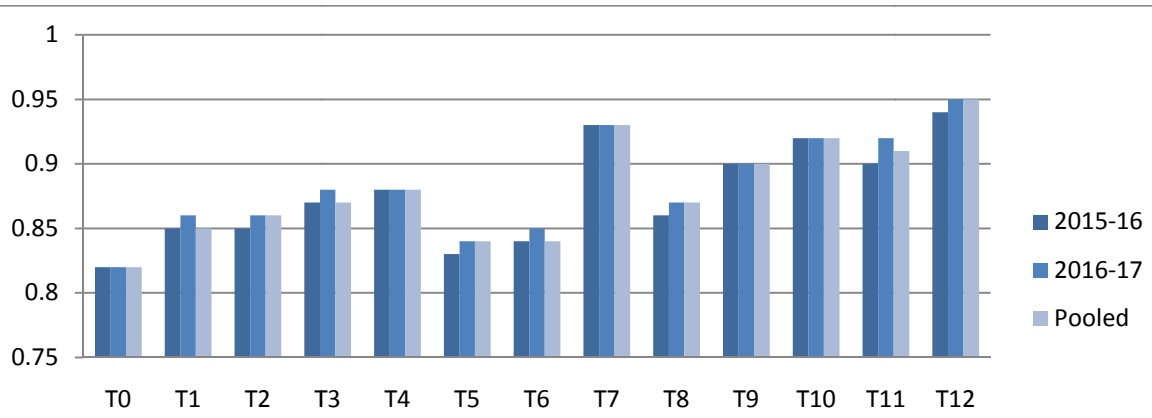

Fig. 4.50 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on specific gravity at 9 day storage

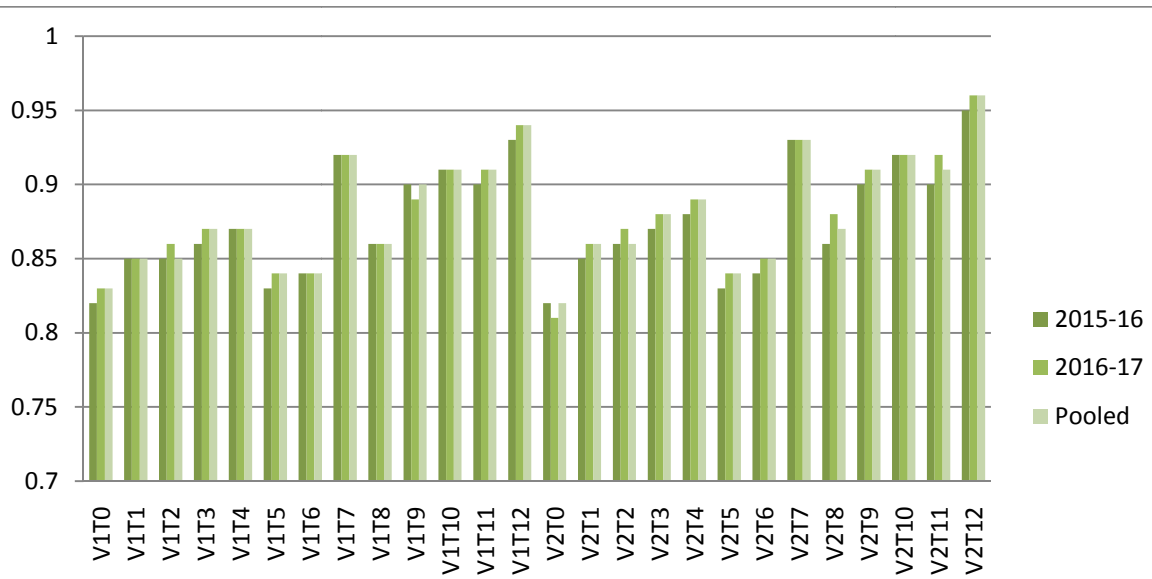

Fig. 4.51 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on specific gravity at 9 day storage

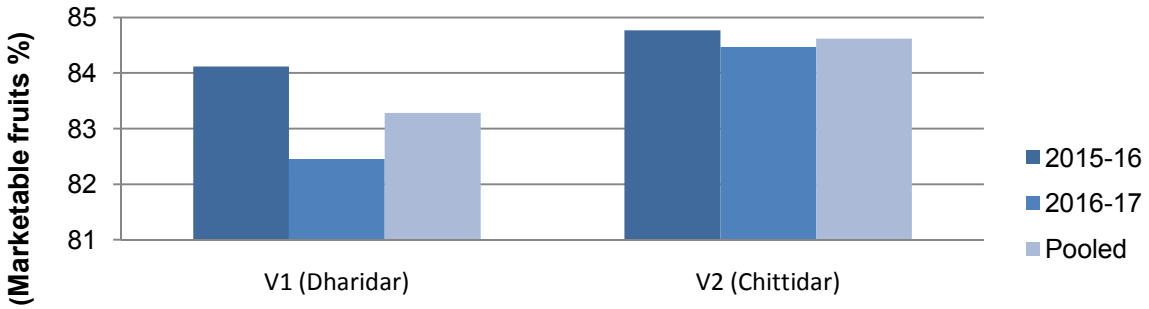

Fig. 4.52 Performance of varieties against marketable fruits (%) at 6 day storage

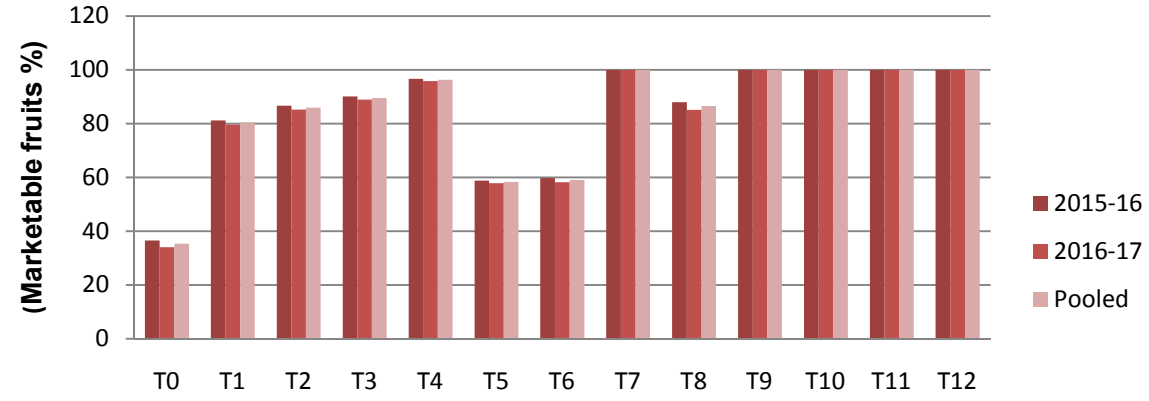

Fig. 4.53 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on marketable fruits (%) at 6 day storage

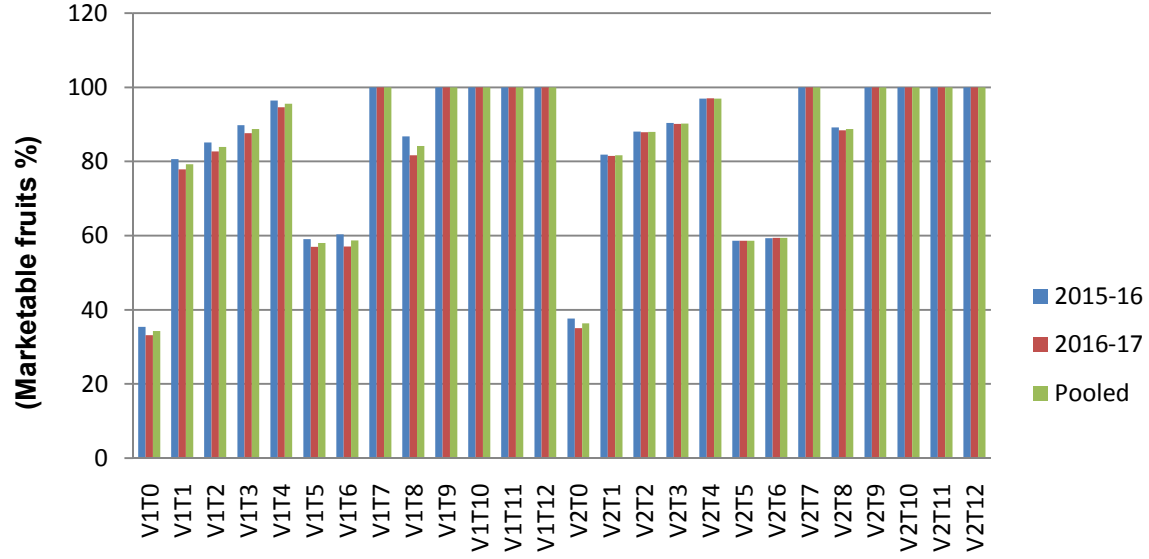

Fig. 4.54 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on marketable fruits (%) at 6 day storage

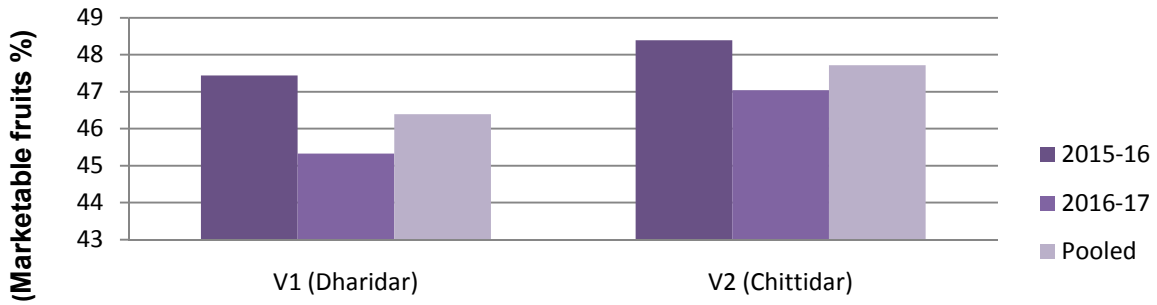

Fig. 4.55 Performance of varieties against marketable fruits (%) at 9 day storage

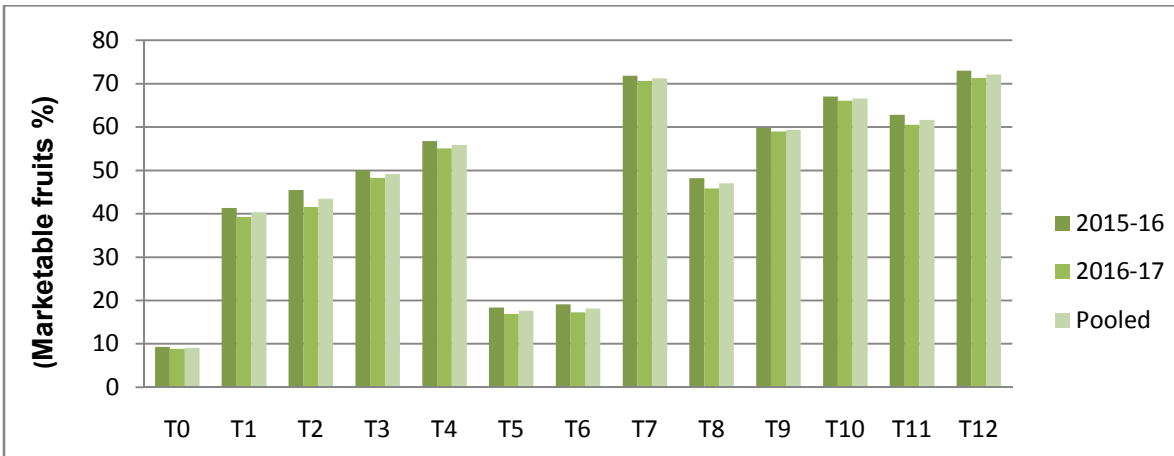

Fig. 4.56 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on marketable fruits (%) at 9 day storage

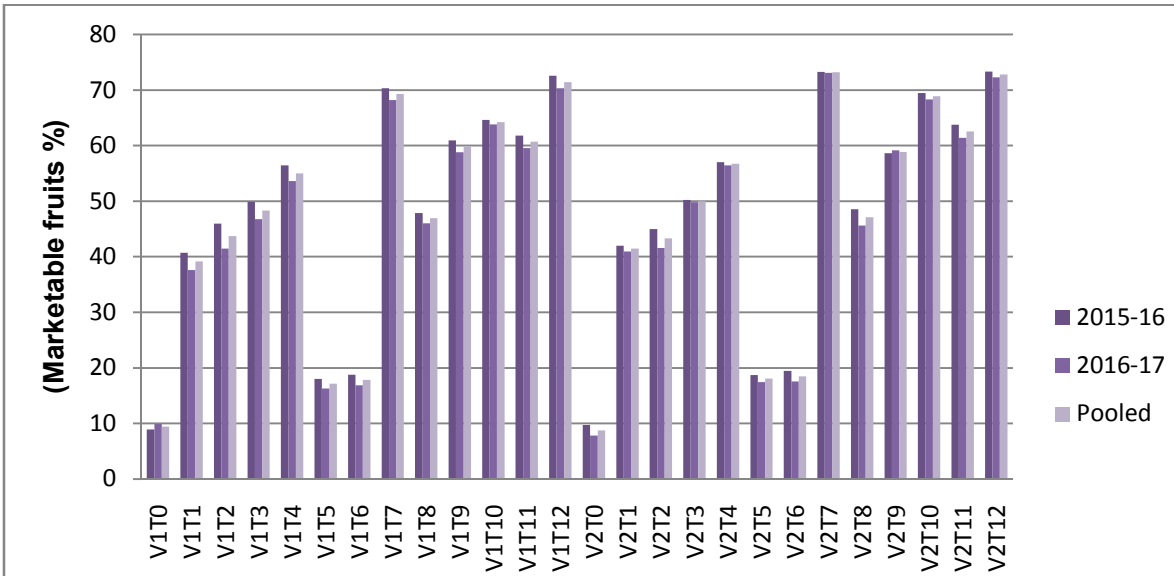

Fig. 4.57 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on marketable fruits (%) at 9 day storage

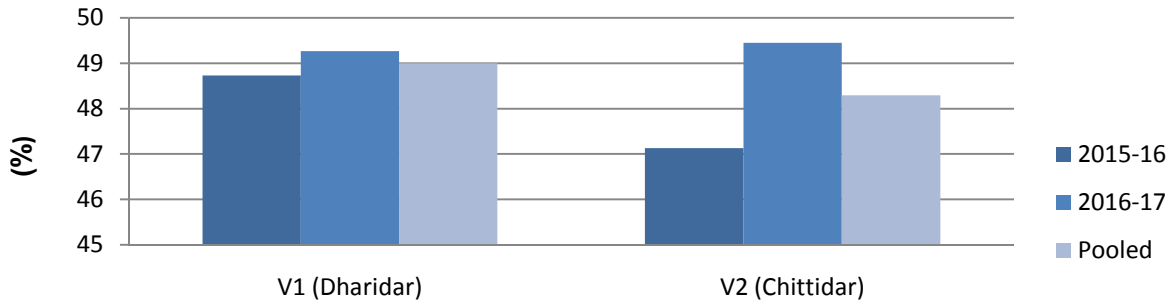

Fig. 4.58 Performance of varieties against marketable fruits retained over control at 6 day storage

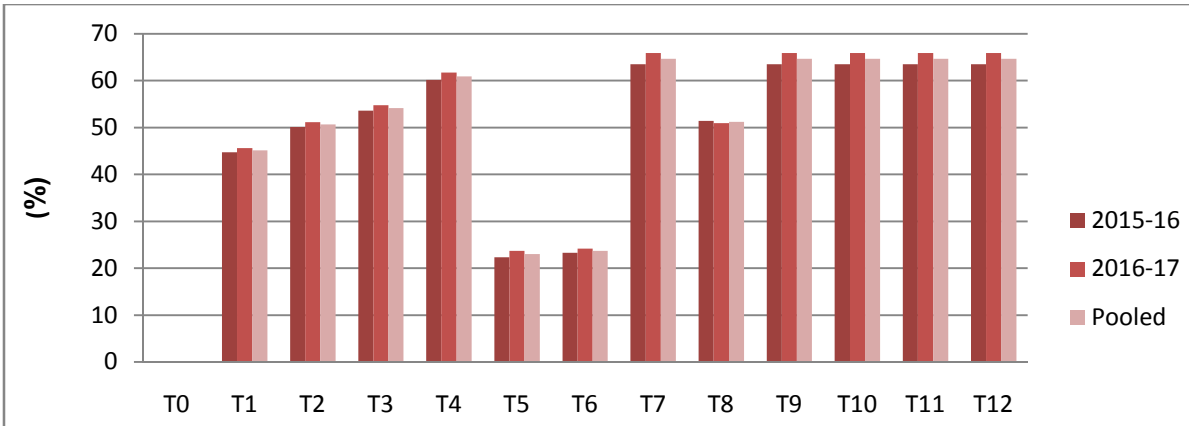

Fig. 4.59 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on marketable fruits retained over control at 6 day storage

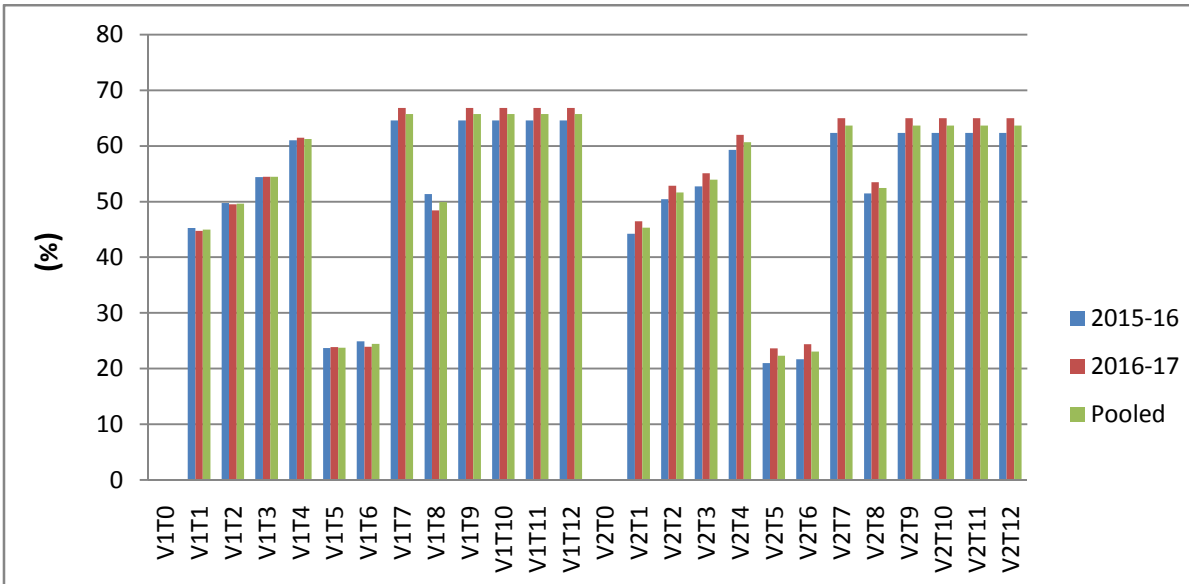

Fig. 4.60 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on marketable fruits retained over control at 6 day storage

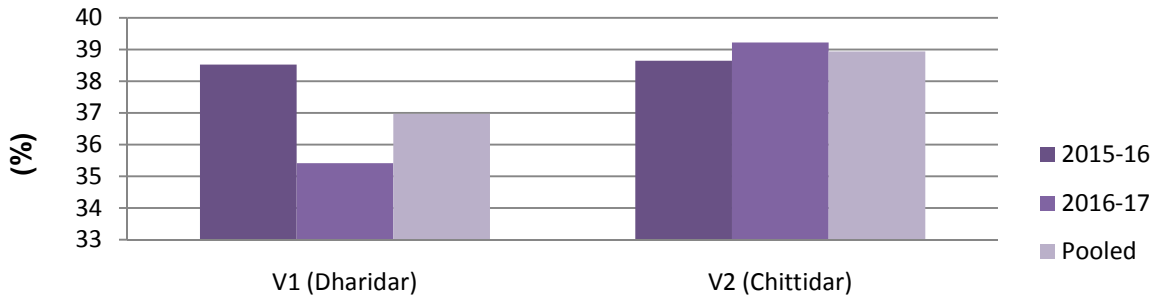

Fig. 4.61 Performance of varieties against marketable fruits retained over control at 9 day storage

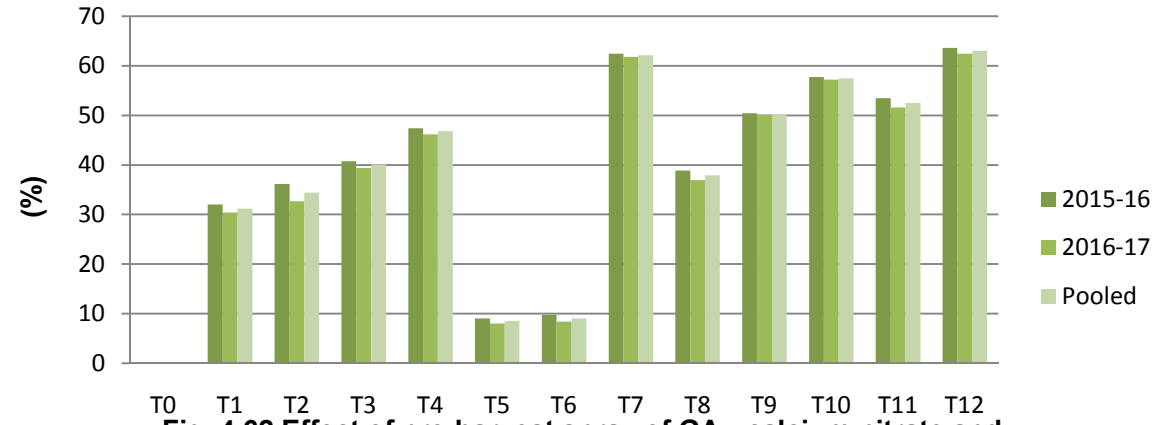

Fig. 4.62 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on marketable fruits retained over control at 9 day storage

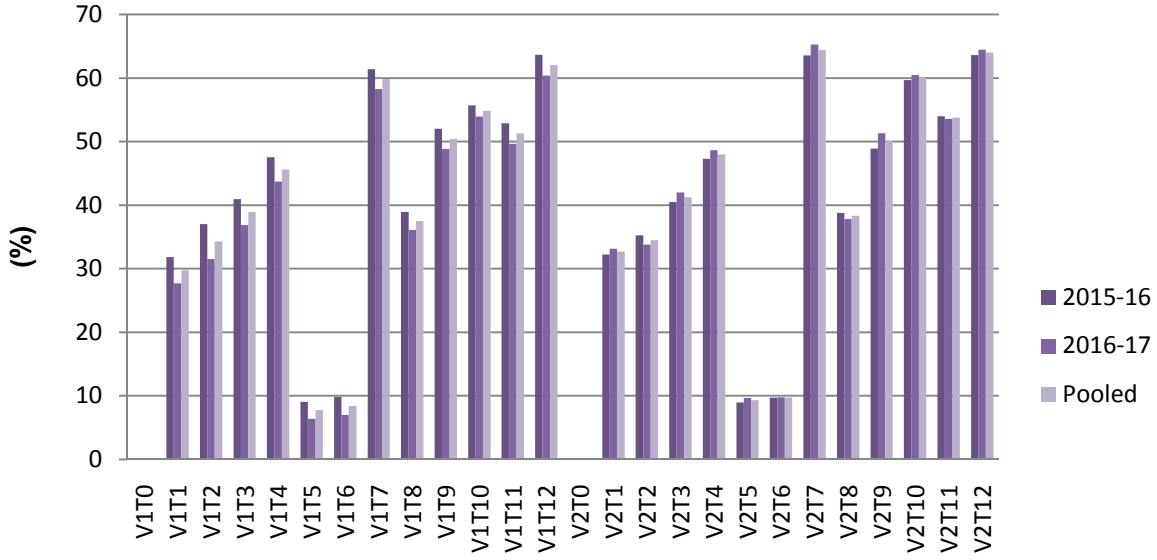

Fig. 4.63 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on marketable fruits retained over control at 9 day storage

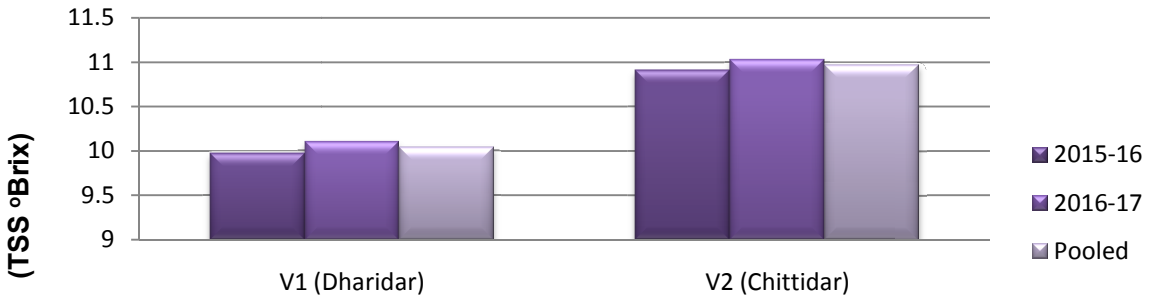

Fig. 4.64 Performance of varieties against TSS (°Brix) at 0 day storage

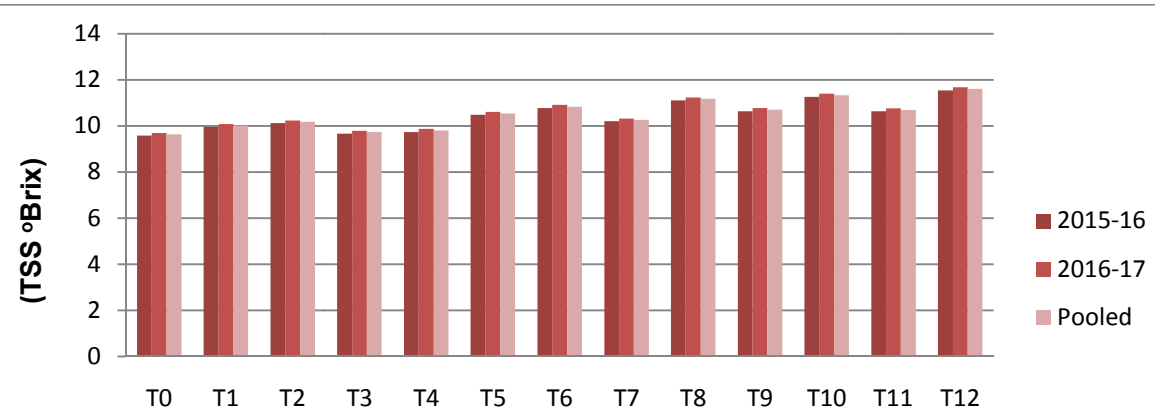

Fig. 4.65 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on TSS (°Brix) at 0 day storage

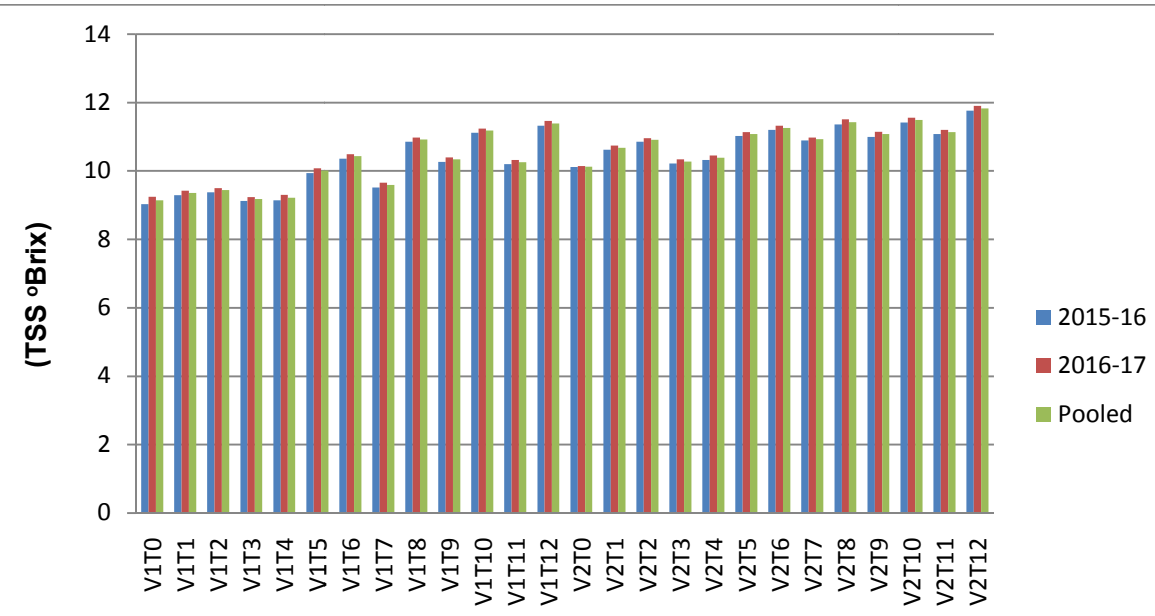

Fig. 4.66 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on TSS (°Brix) at 0 day storage

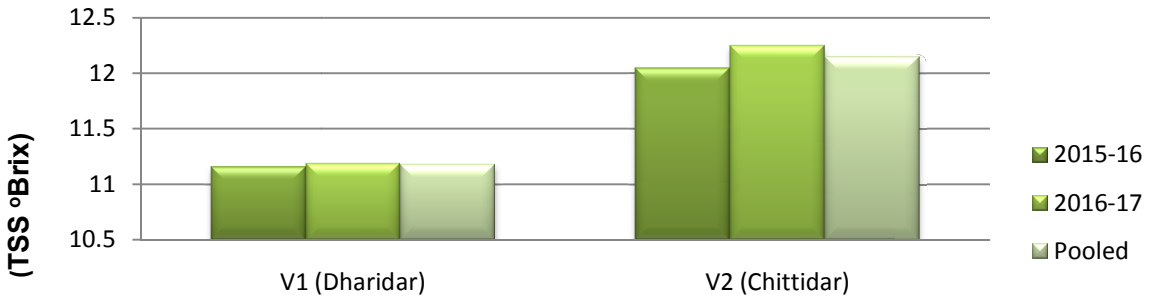

Fig. 4.67 Performance of varieties against TSS (°Brix) at 3 day storage

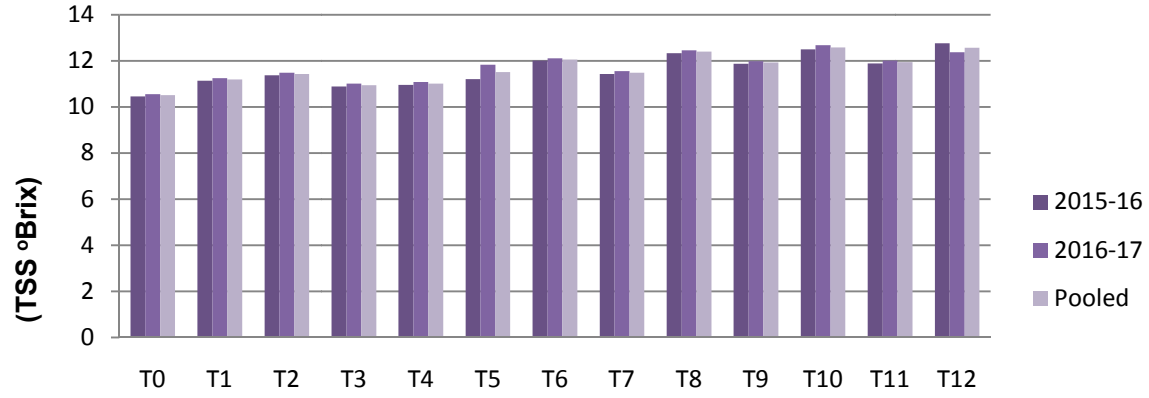

Fig. 4.68 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on TSS (°Brix) at 3 day storage

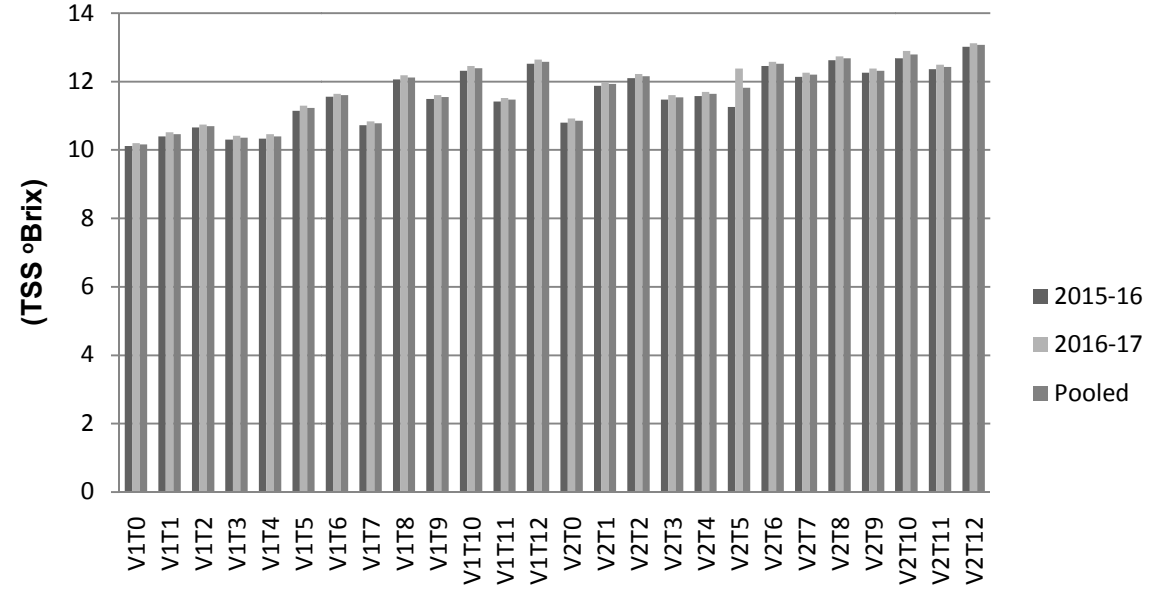

Fig. 4.69 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on TSS (°Brix) at 3 day storage

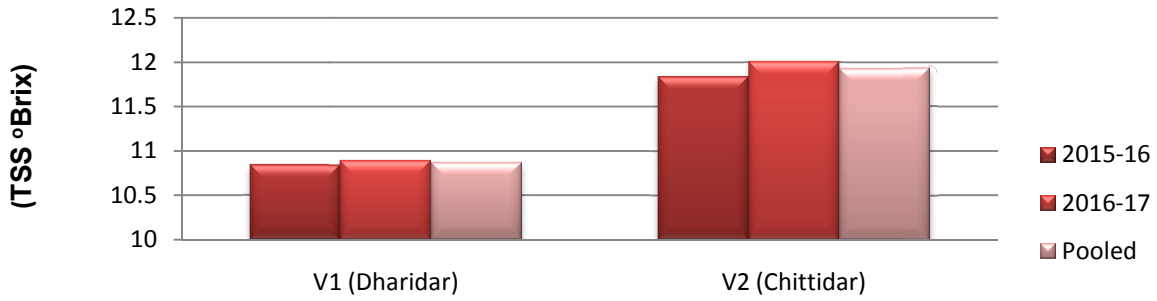

Fig. 4.70 Performance of varieties against TSS (°Brix) at 6 day storage

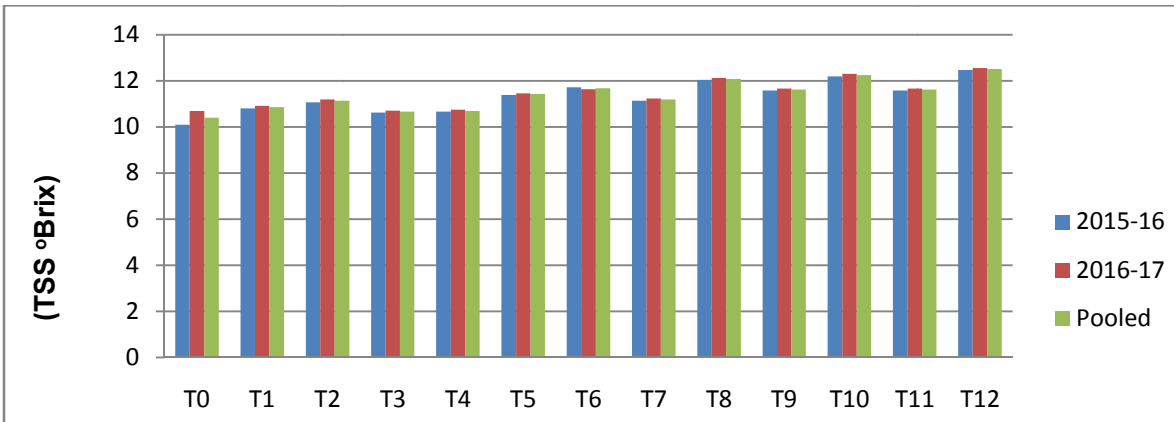

Fig. 4.71 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on TSS (°Brix) at 6 day storage

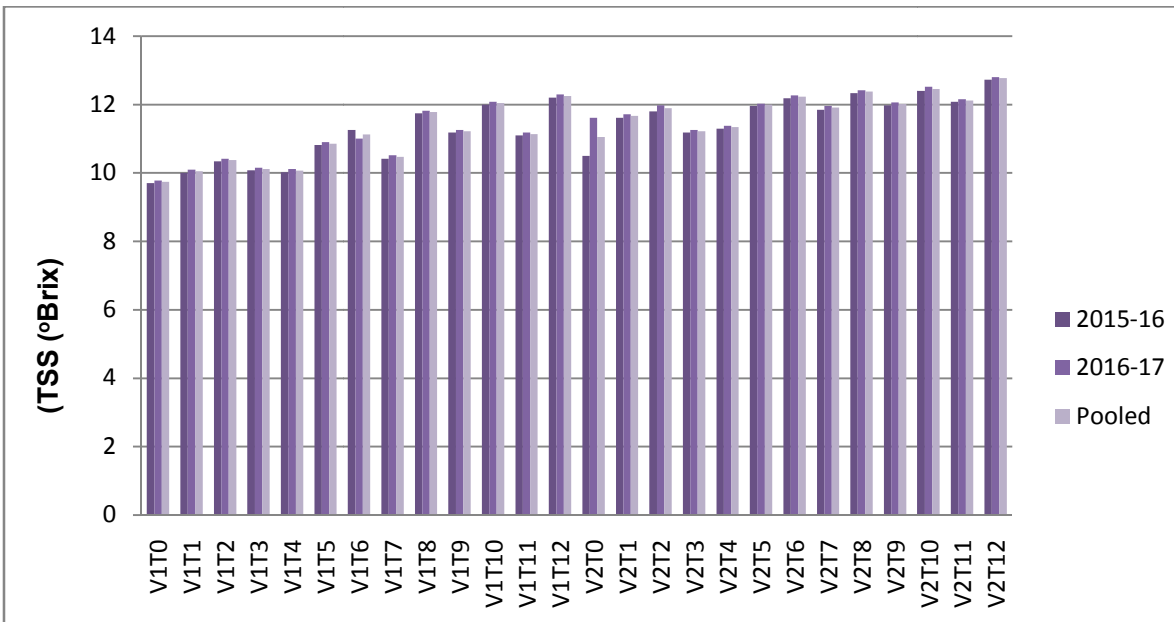

Fig. 4.72 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on TSS (°Brix) at 6 day storage

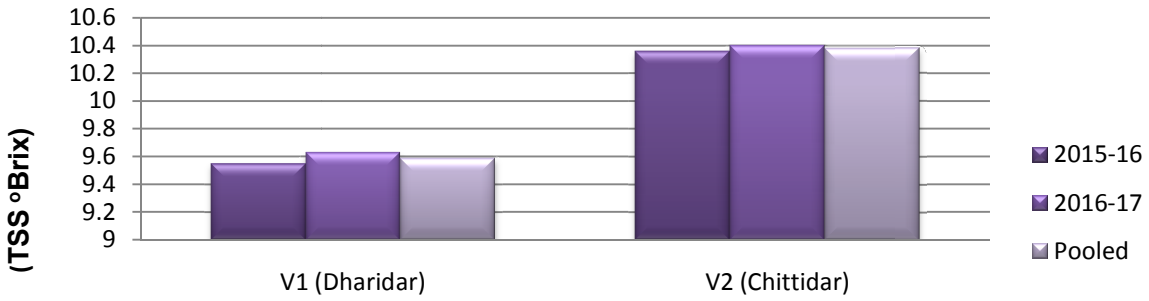

Fig. 4.73 Performance of varieties against TSS (°Brix) at 9 day storage

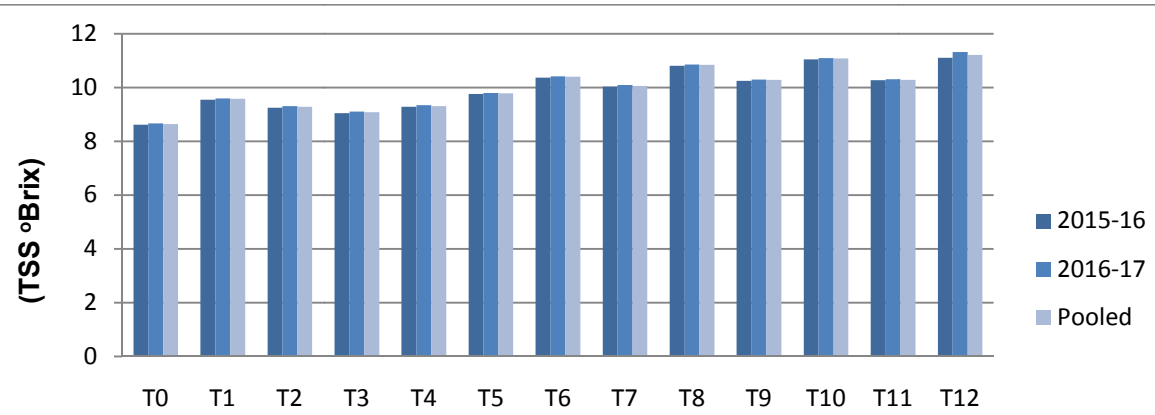

Fig. 4.74 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on TSS (°Brix) at 9 day storage

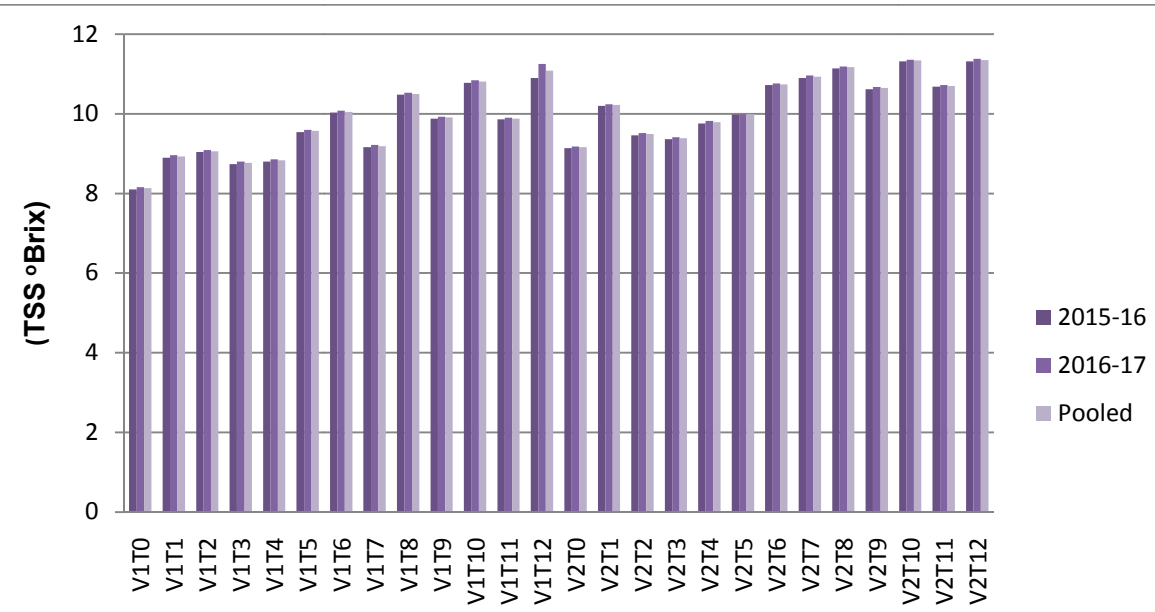

Fig. 4.75 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on TSS (°Brix) at 9 day storage

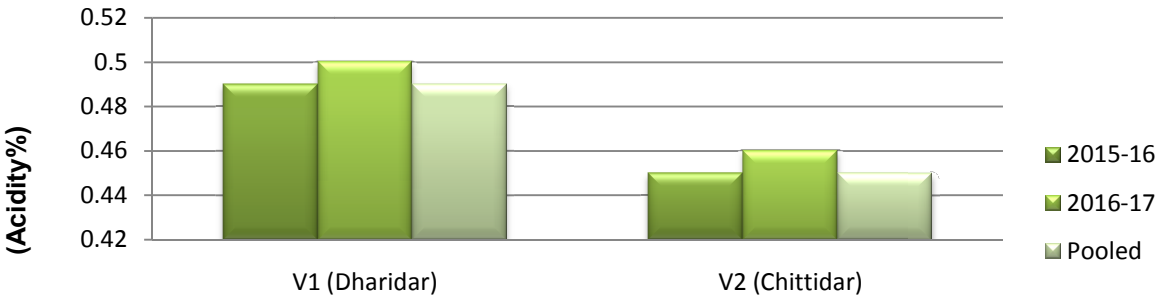

Fig. 4.76 Performance of varieties against acidity (%) at 0 day storage

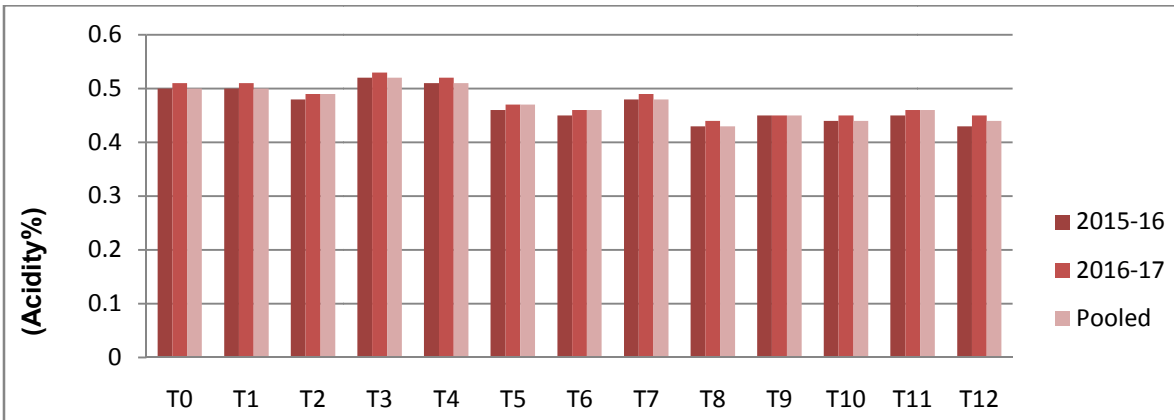

Fig. 4.77 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on acidity (%) at 0 day storage

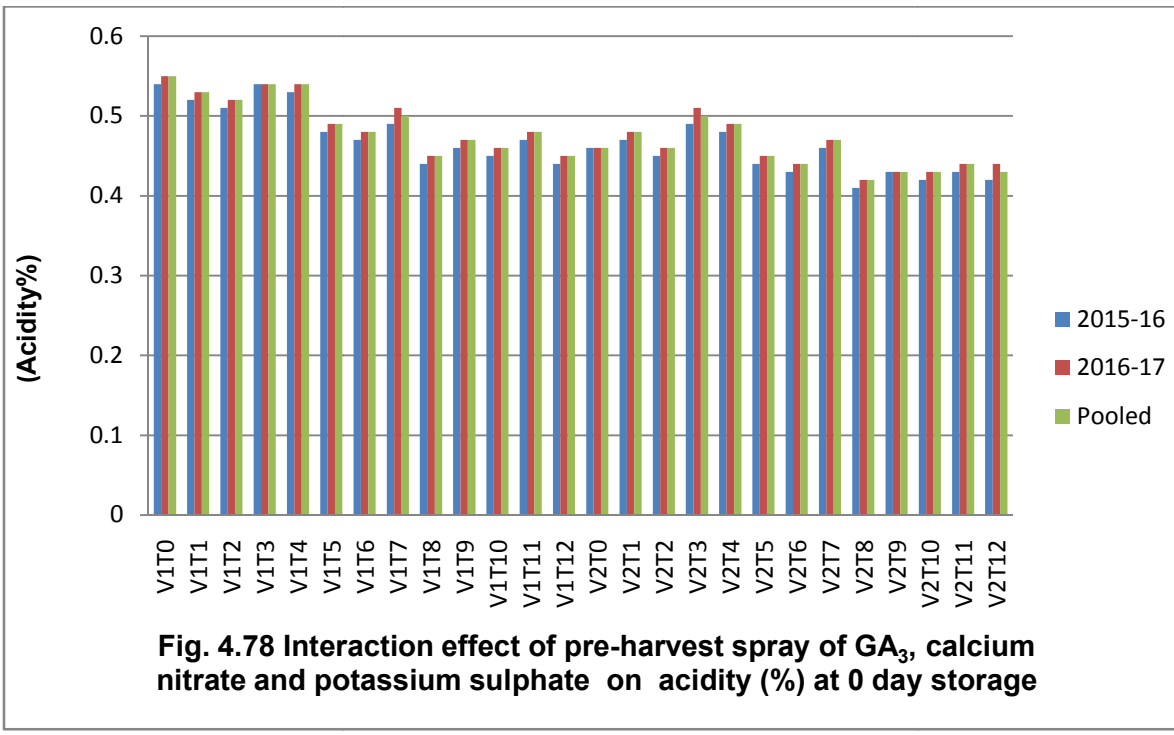

Fig. 4.78 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on acidity (%) at 0 day storage

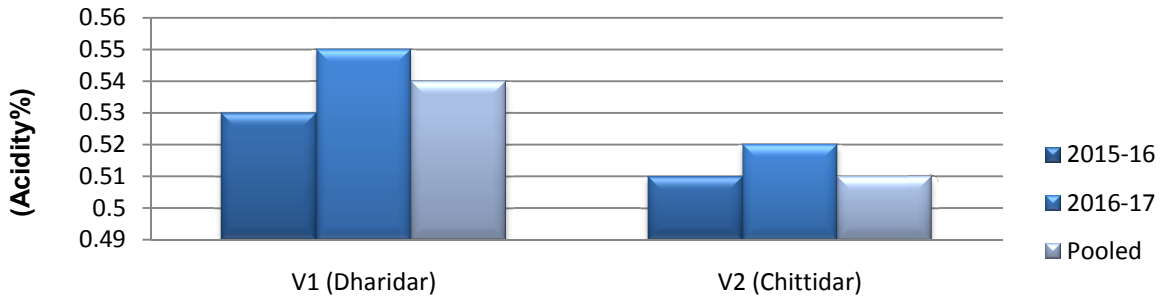

Fig. 4.79 Performance of varieties against acidity (%) at 3 day storage

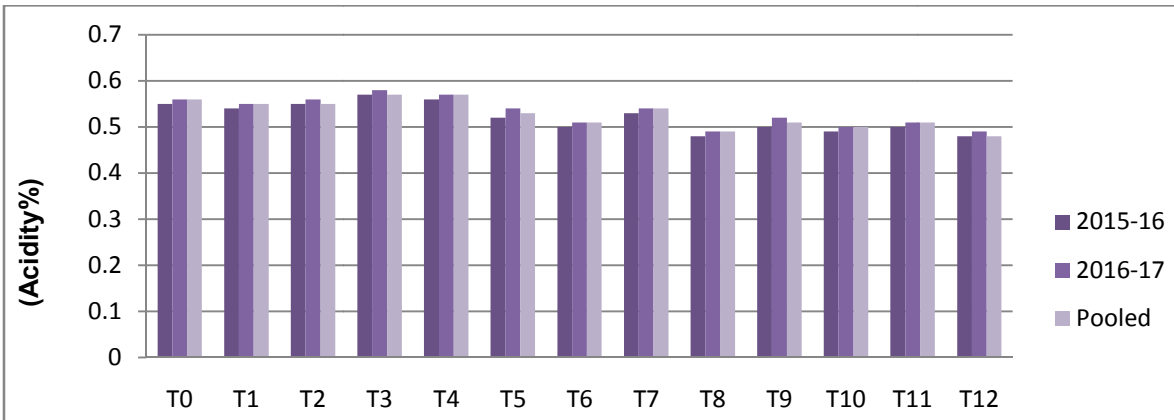

Fig. 4.80 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on acidity (%) at 3 day storage

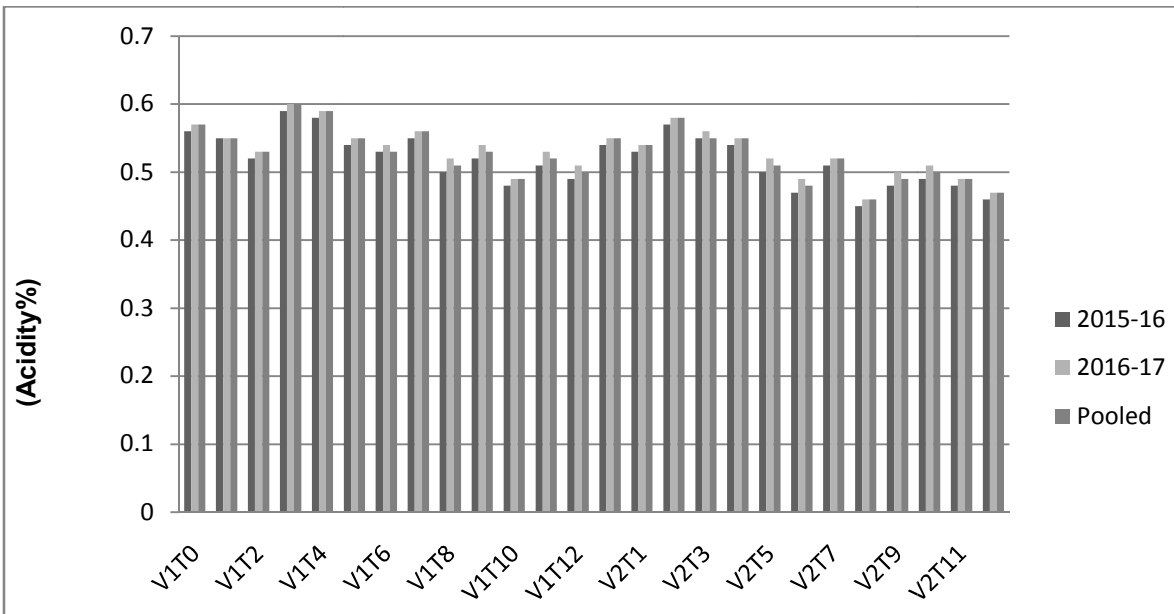

Fig. 4.81 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on acidity (%) at 3 day storage

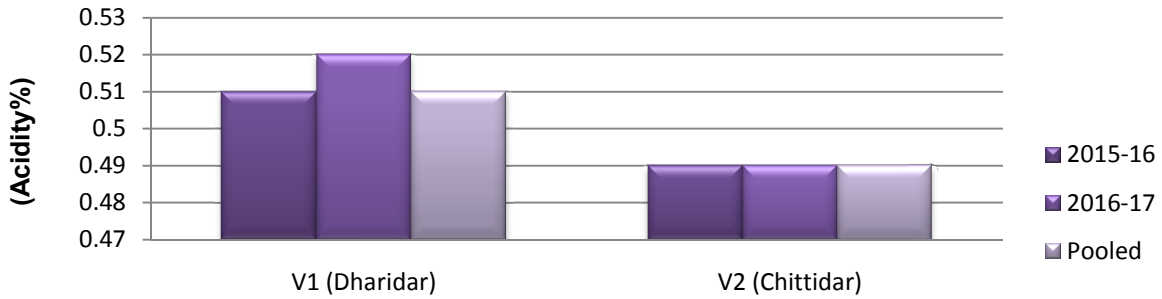

Fig. 4.82 Performance of varieties against acidity (%) at 6 day storage

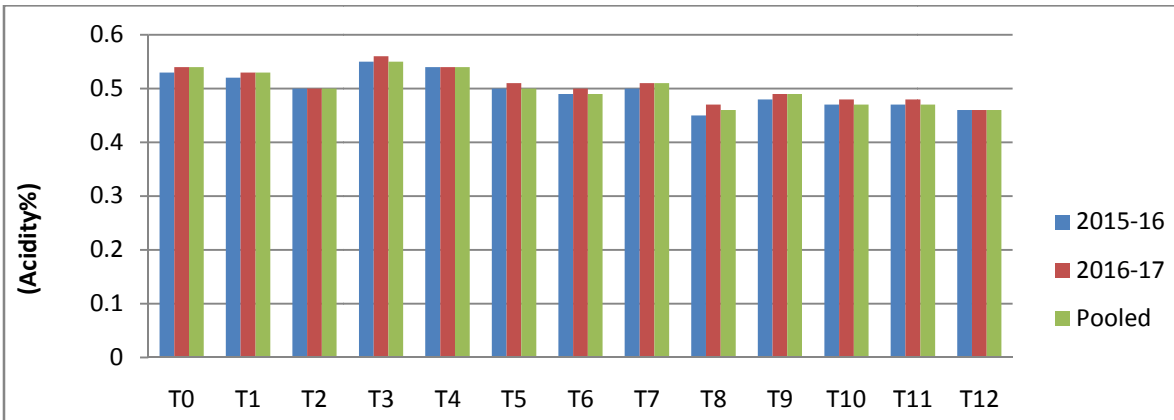

Fig. 4.83 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on acidity (%) at 6 day storage

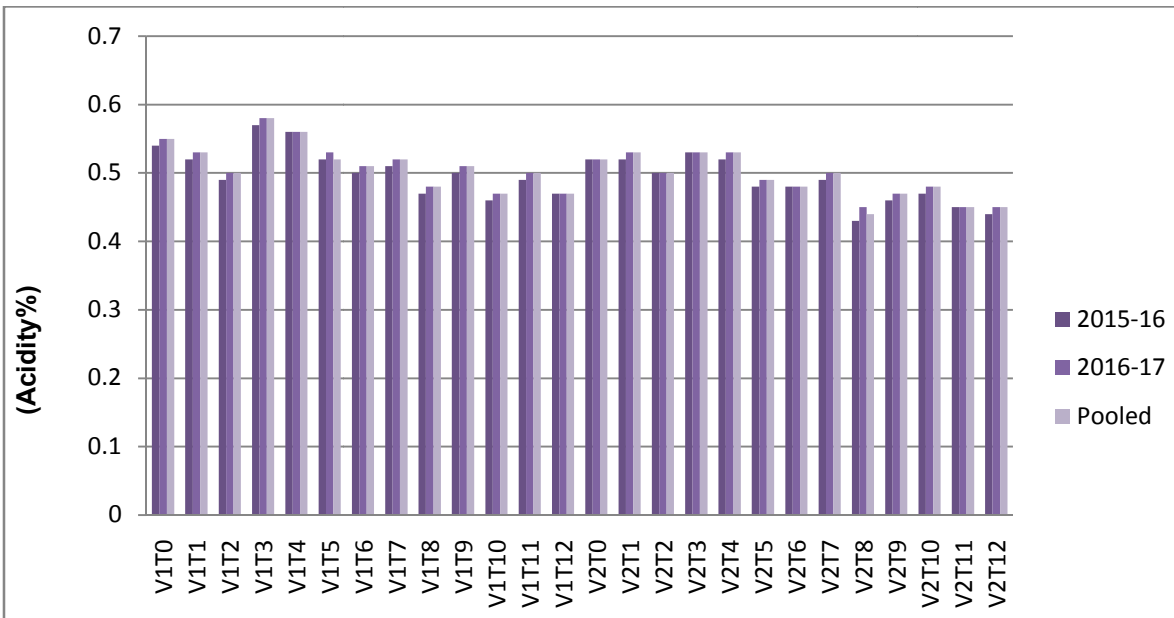

Fig. 4.84 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on acidity (%) at 6 day storage

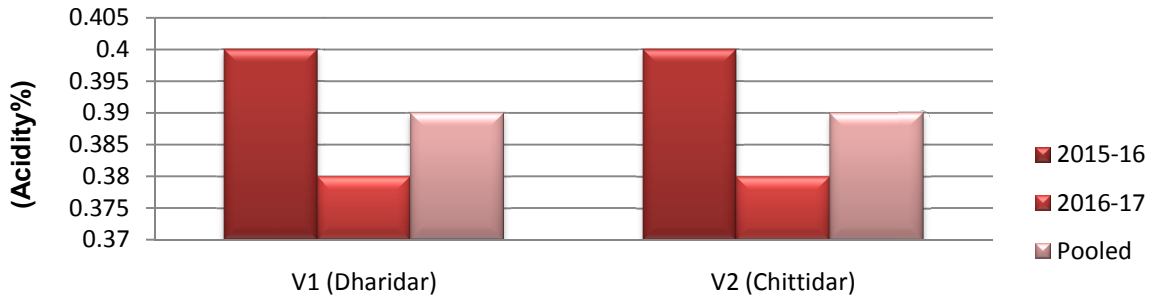

Fig. 4.85 Performance of varieties against acidity (%) at 9 day storage

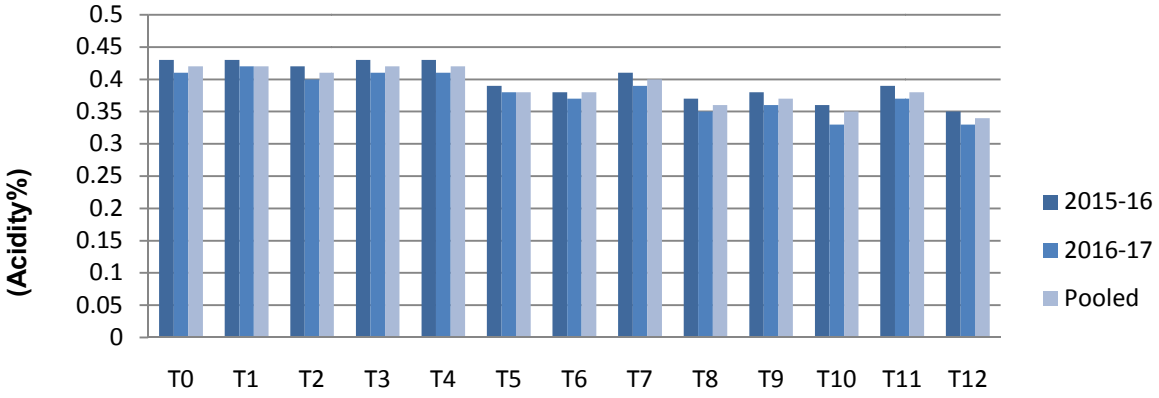

Fig. 4.86 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on acidity (%) at 9 day storage

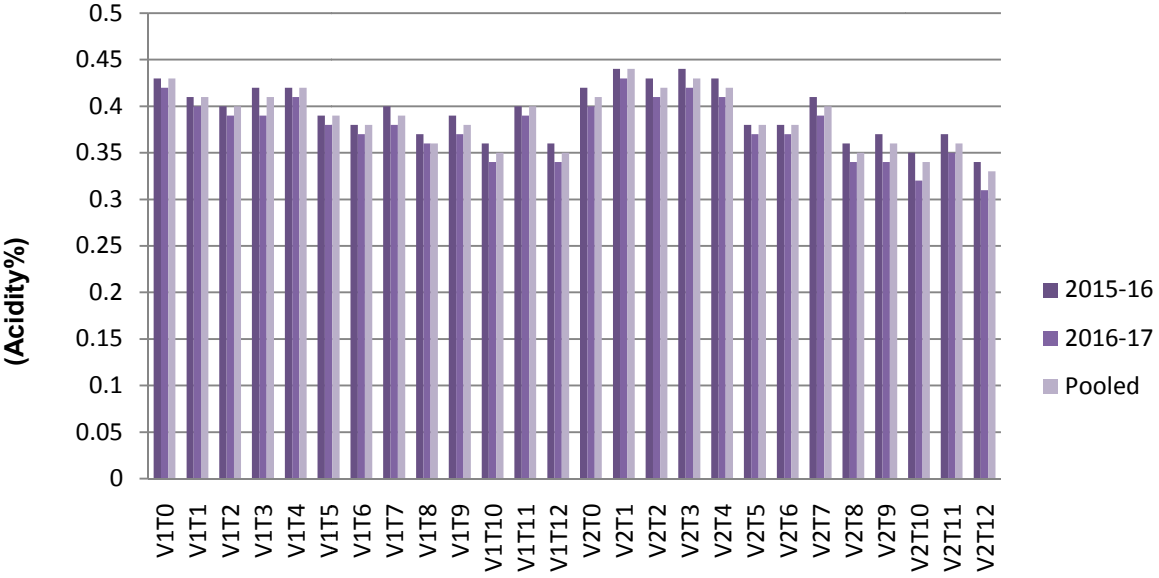

Fig. 4.87 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on acidity (%) at 9 day storage

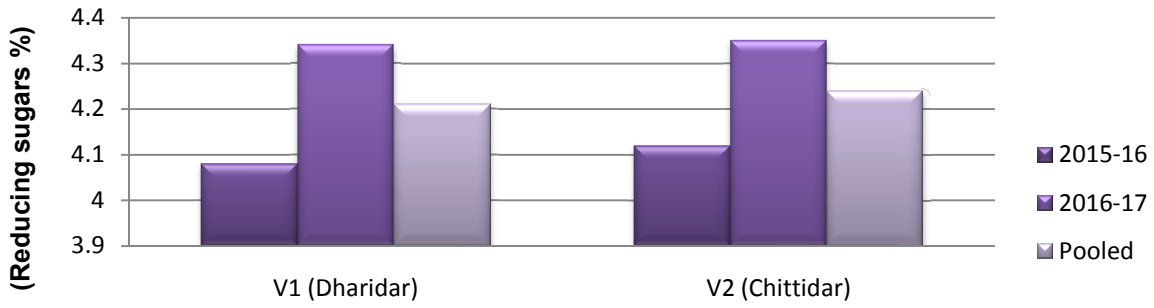

Fig. 4.88 Performance of varieties against reducing sugars (%) at 0 day storage

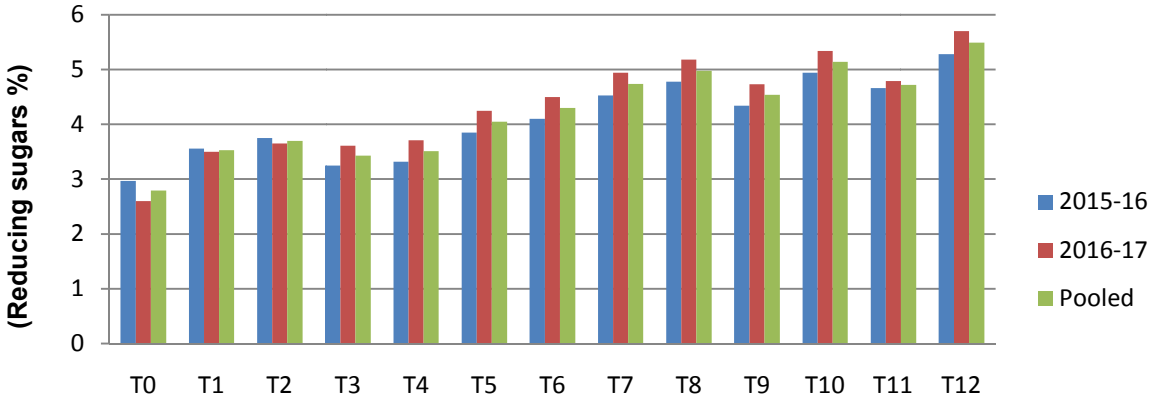

Fig. 4.89 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on reducing sugars (%) at 0 day storage

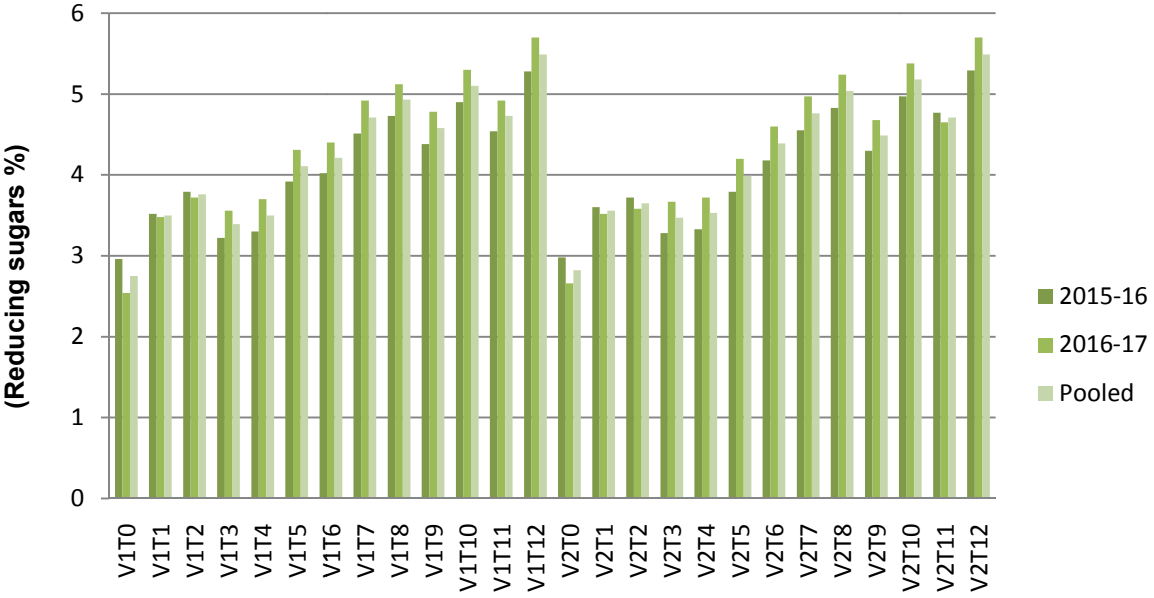

Fig. 4.90 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on reducing sugars (%) at 0 day storage

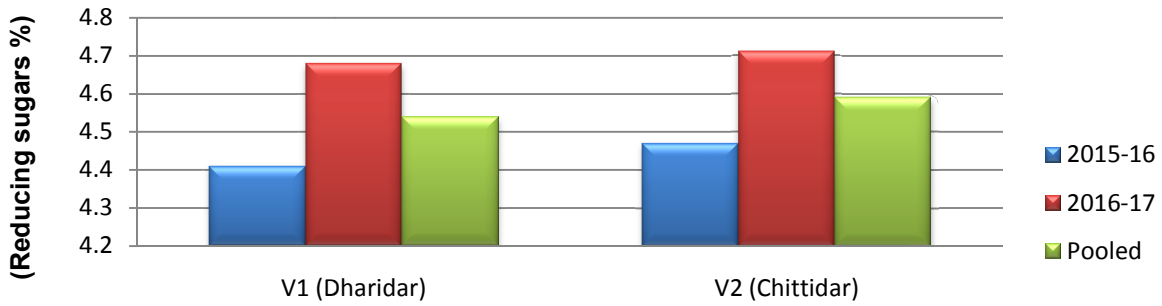

Fig. 4.91 Performance of varieties against reducing sugars (%) at 3 day storage

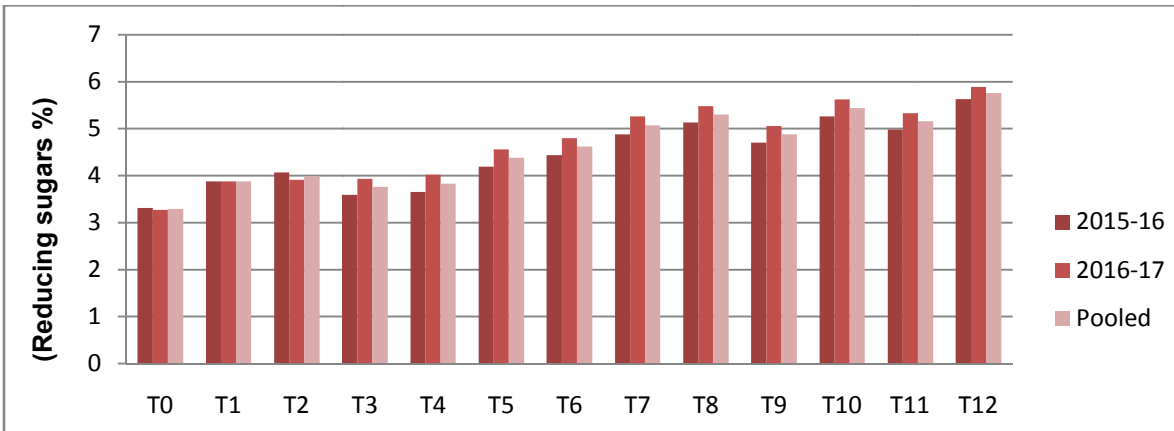

Fig. 4.92 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on reducing sugars (%) at 3 day storage

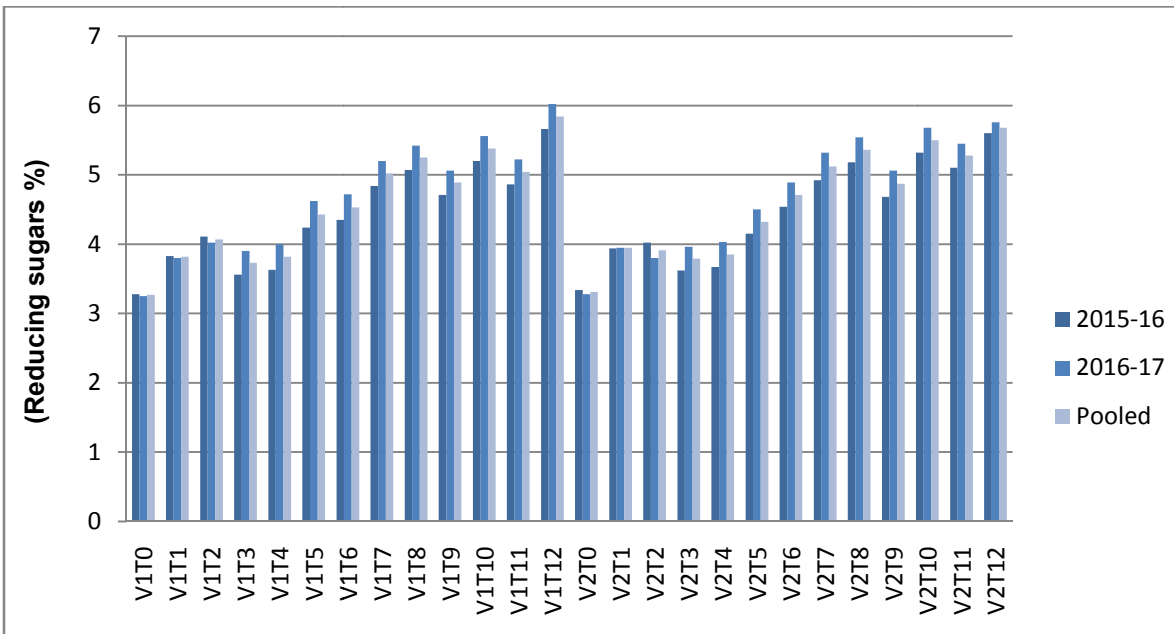

Fig. 4.93 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on reducing sugars (%) at 3 day storage

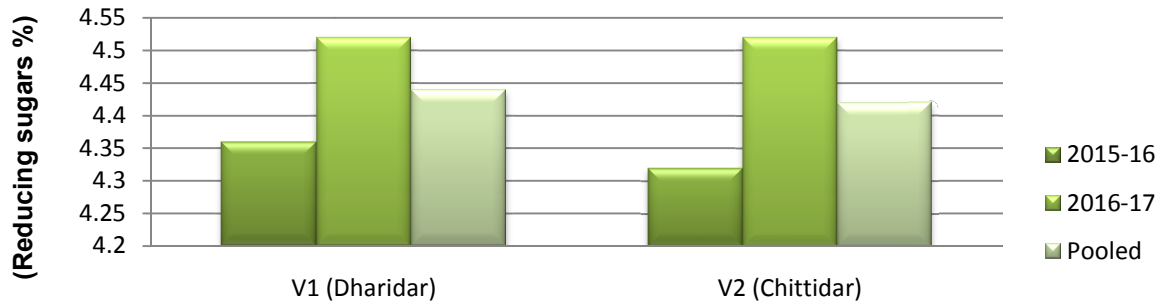

Fig. 4.94 Performance of varieties against reducing sugars (%) at 6 day storage

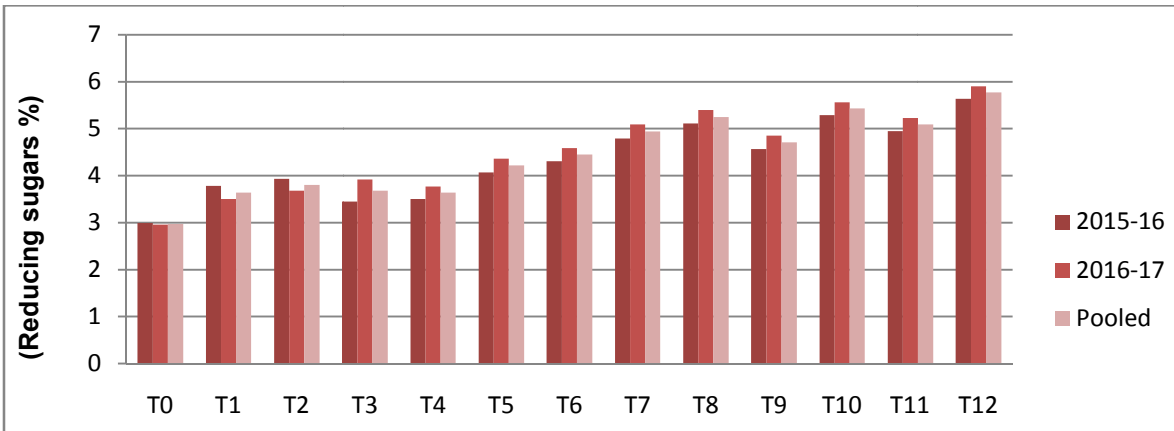

Fig. 4.95 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on reducing sugars (%) at 6 day storage

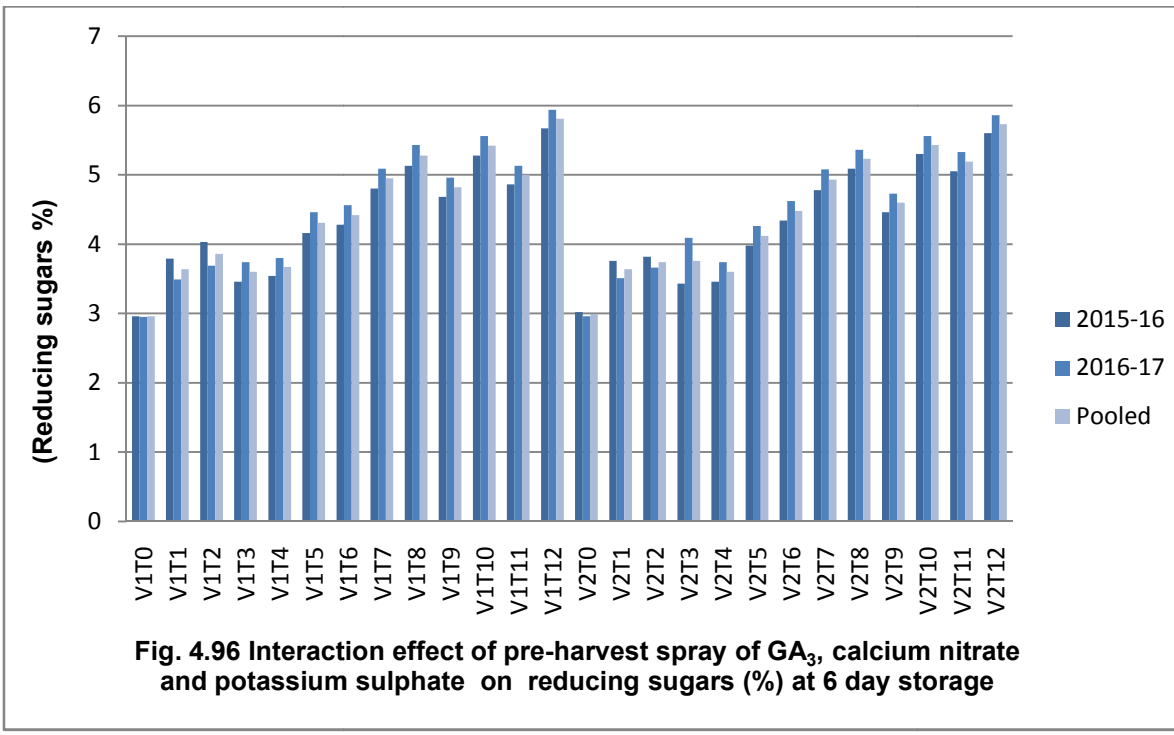

Fig. 4.96 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on reducing sugars (%) at 6 day storage

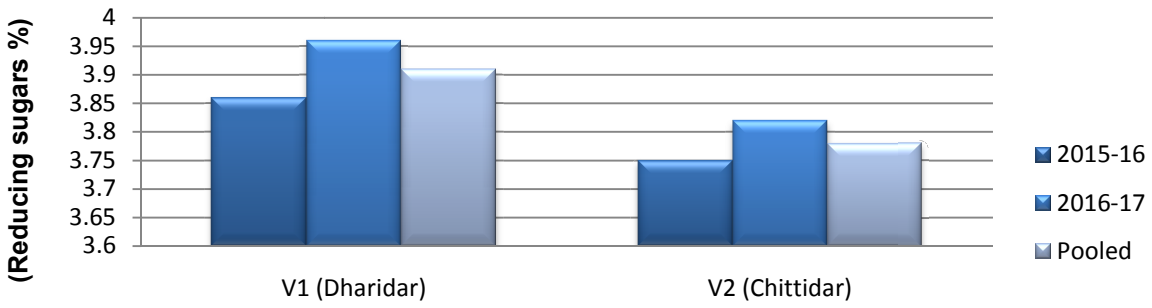

Fig. 4.97 Performance of varieties against reducing sugars (%) at 9 day storage

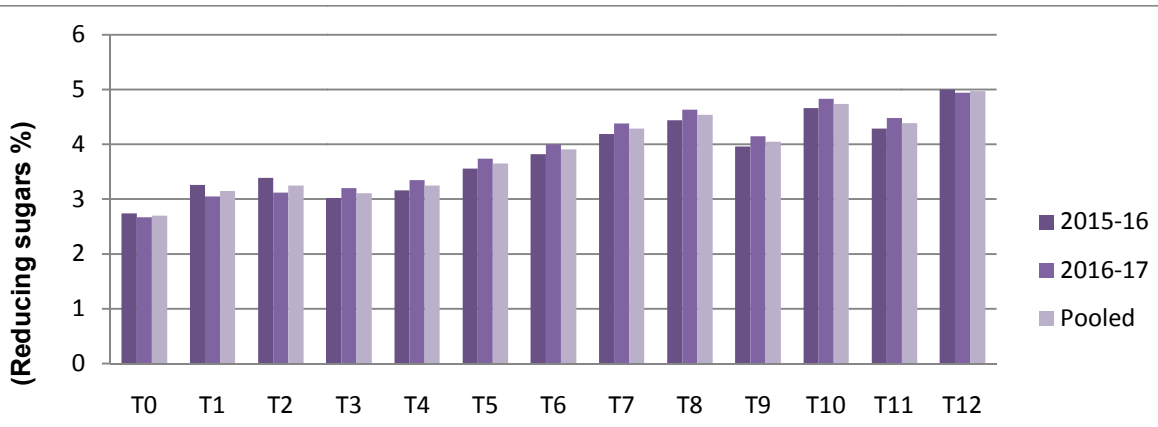

Fig. 4.98 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on reducing sugars (%) at 9 day storage

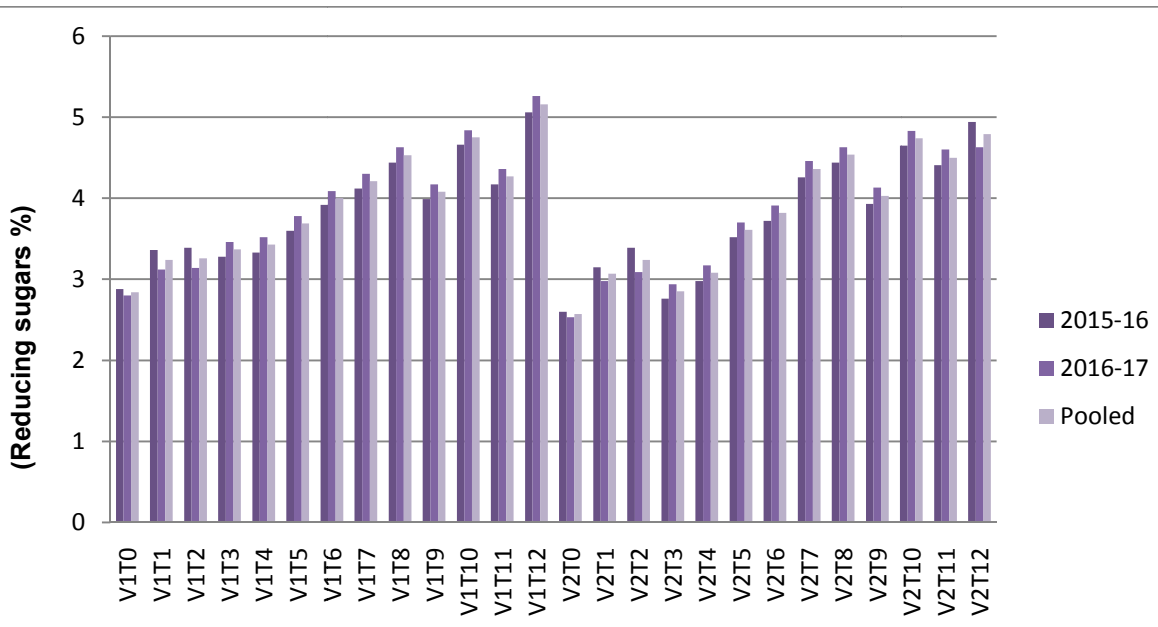

Fig. 4.99 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on reducing sugars (%) at 9 day storage

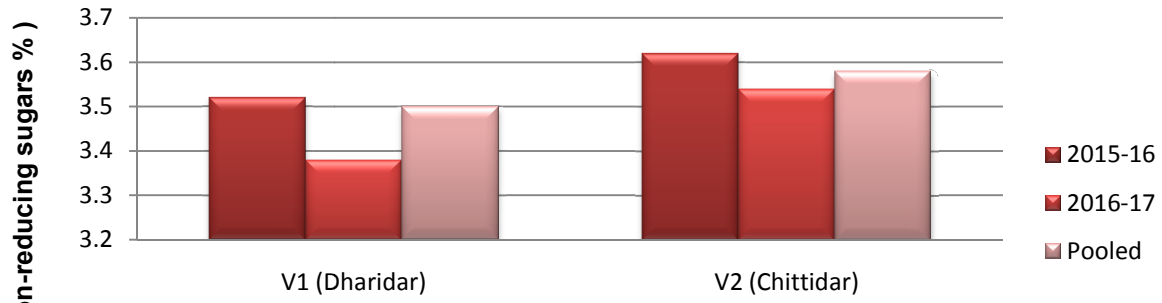

Fig. 4.100 Performance of varieties against non-reducing sugars (%) at 0 day storage

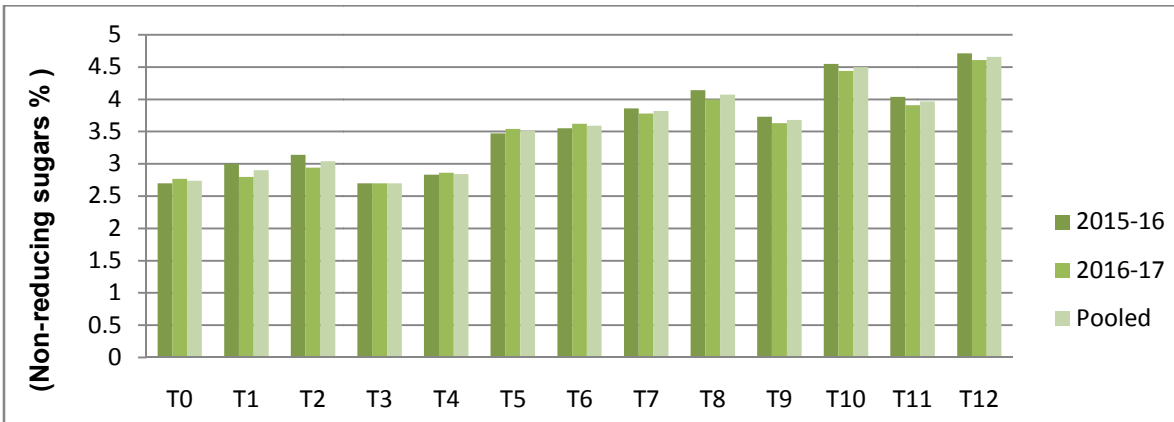

Fig. 4.101 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on non-reducing sugars (%) at 0 day storage

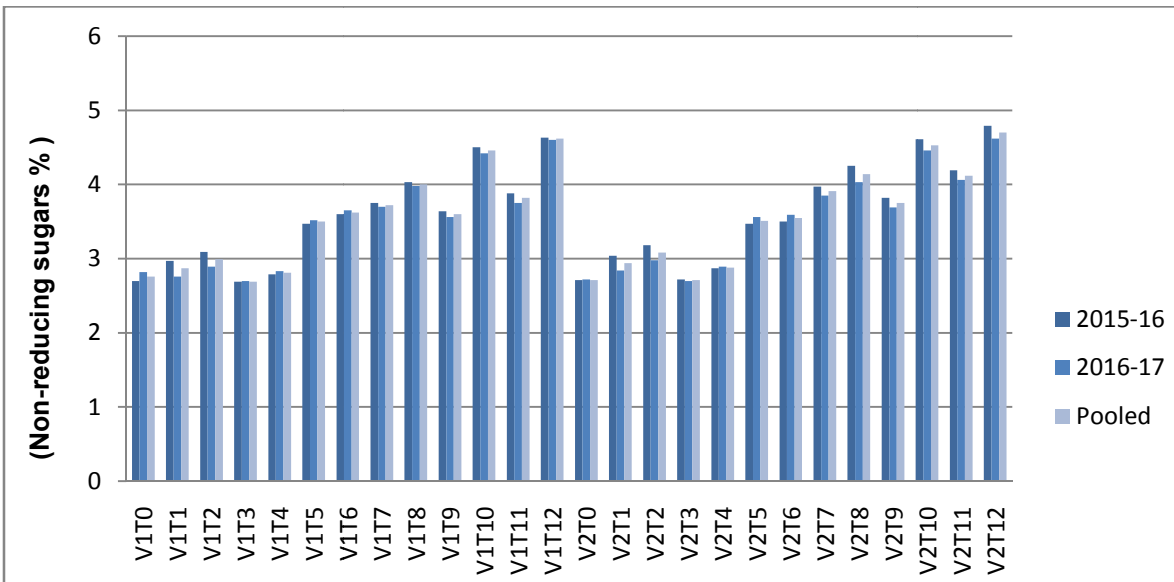

Fig. 4.102 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on non-reducing sugars (%) at 0 day storage

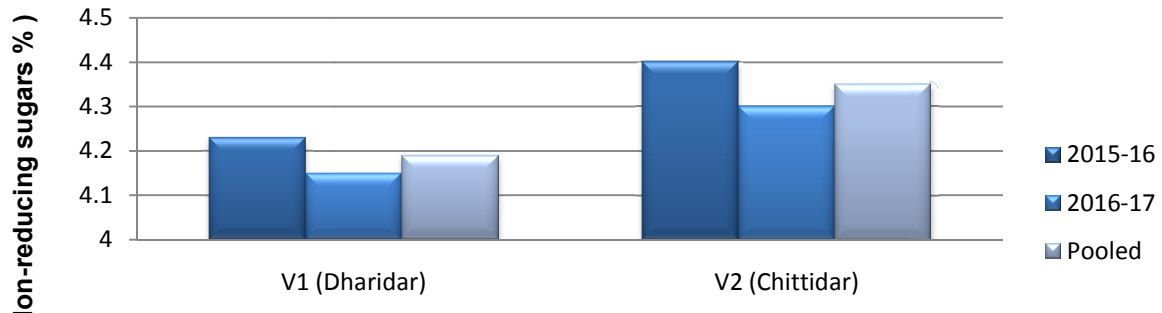

Fig. 4.103 Performance of varieties against non-reducing sugars (%) at 3 day storage

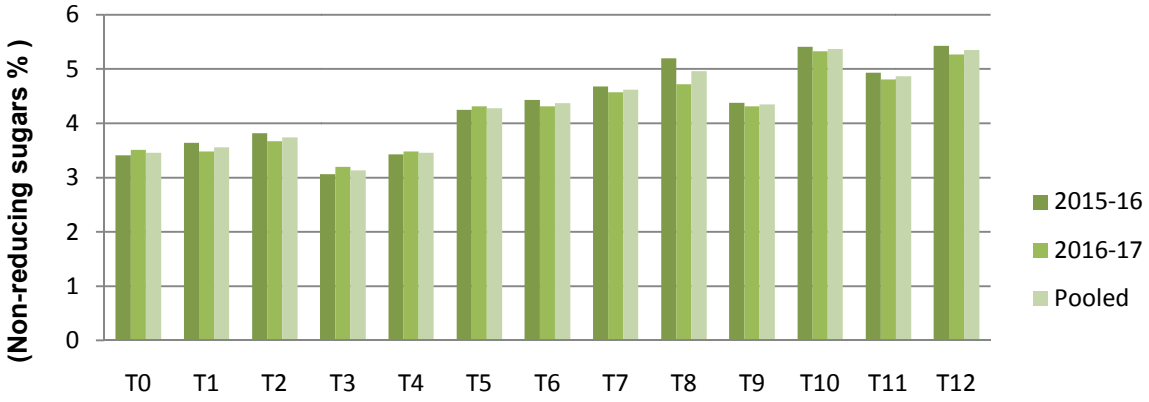

Fig. 4.104 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on non-reducing sugars (%) at 3 day storage

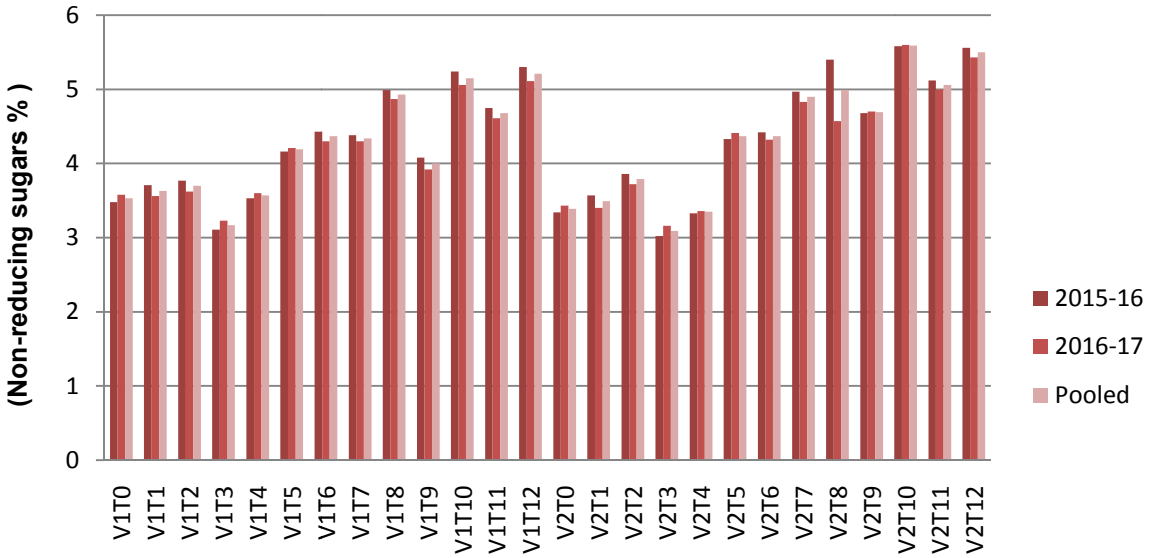

Fig. 4.105 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on non-reducing sugars (%) at 3 day storage

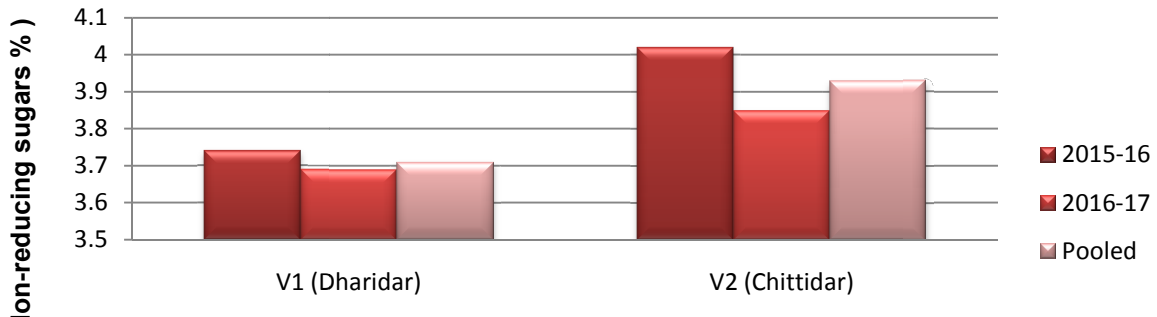

Fig. 4.106 Performance of varieties against non reducing sugars (%) at 6 day storage

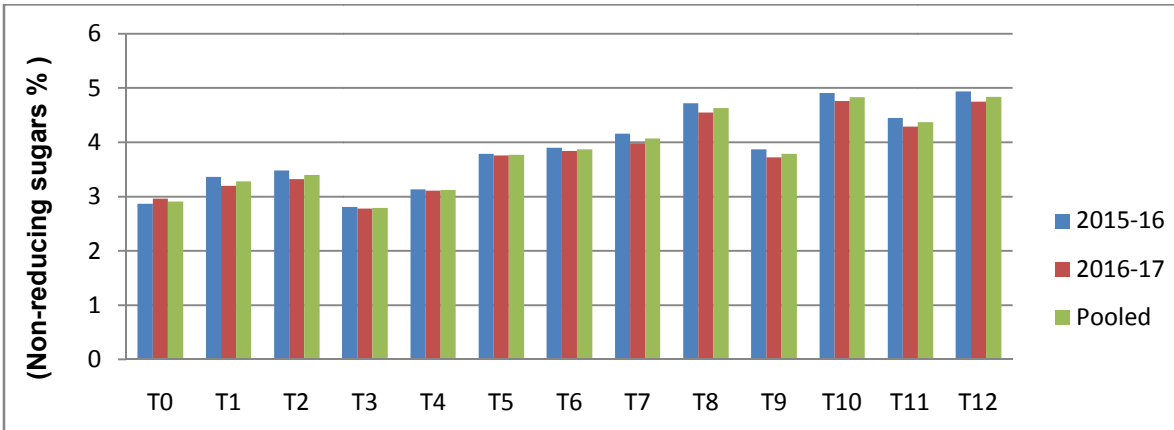

Fig. 4.107 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on non-reducing sugars (%) at 6 day storage

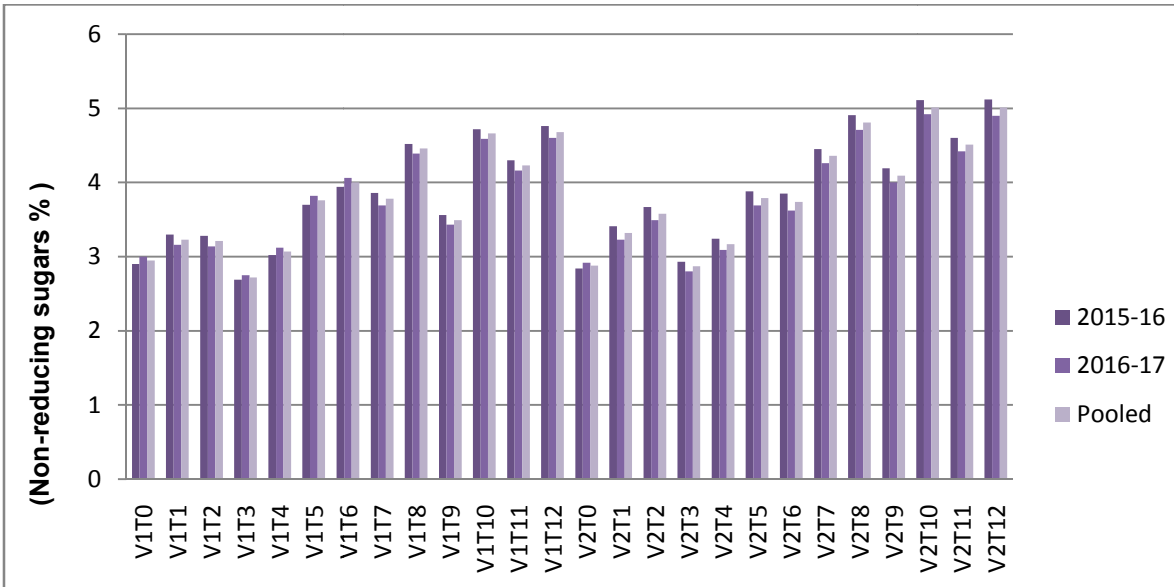

Fig. 4.108 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on non-reducing sugars (%) at 6 day storage

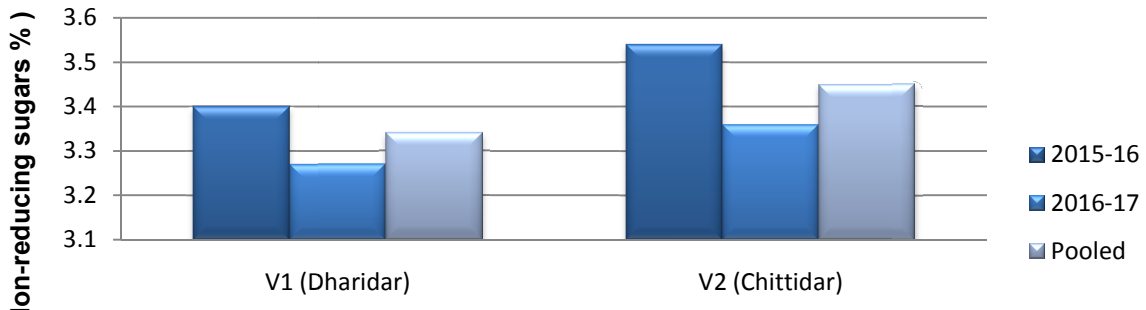

Fig. 4.109 Performance of varieties against non-reducing sugars (%) at 9 day storage

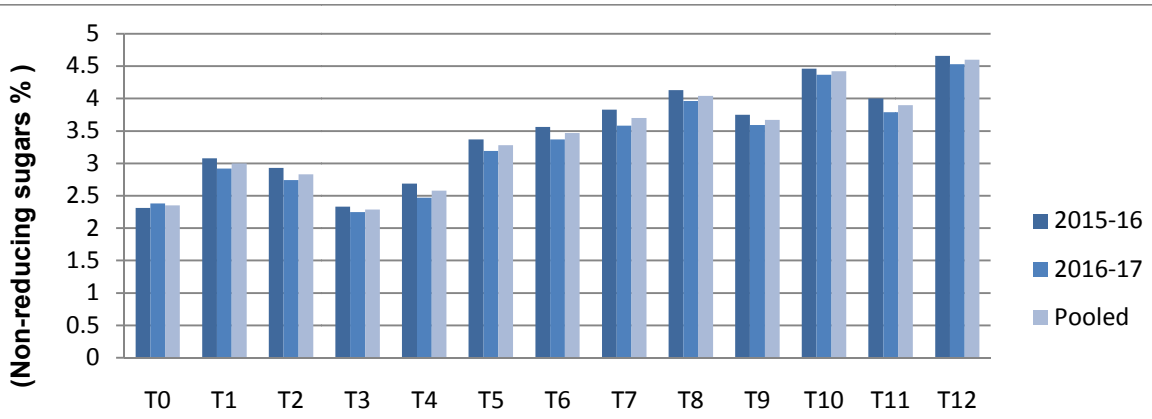

Fig. 4.110 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on non-reducing sugars (%) at 9 day storage

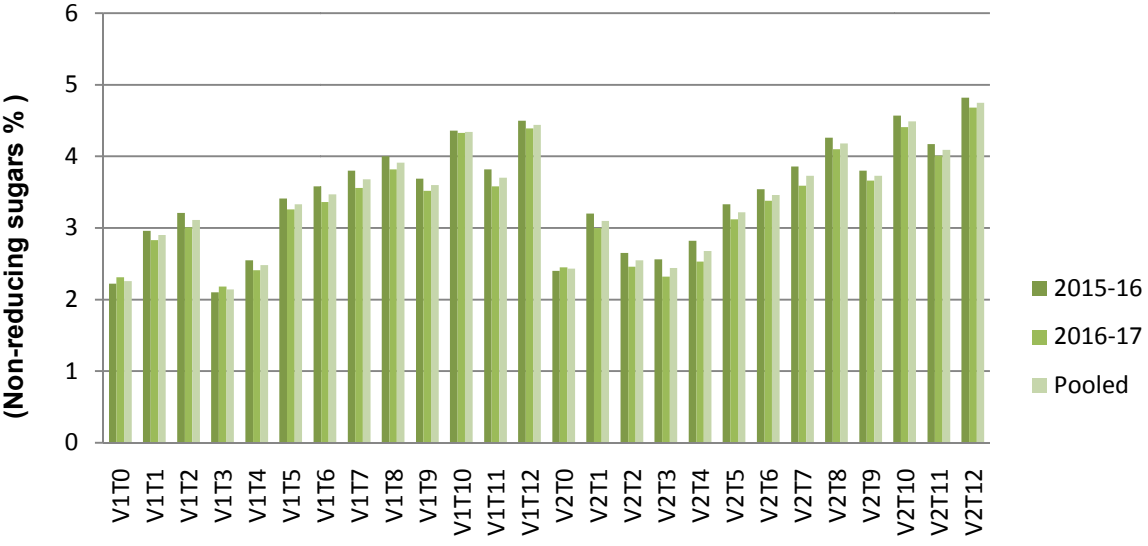

Fig. 4.111 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on non-reducing sugars (%) at 9 day storage

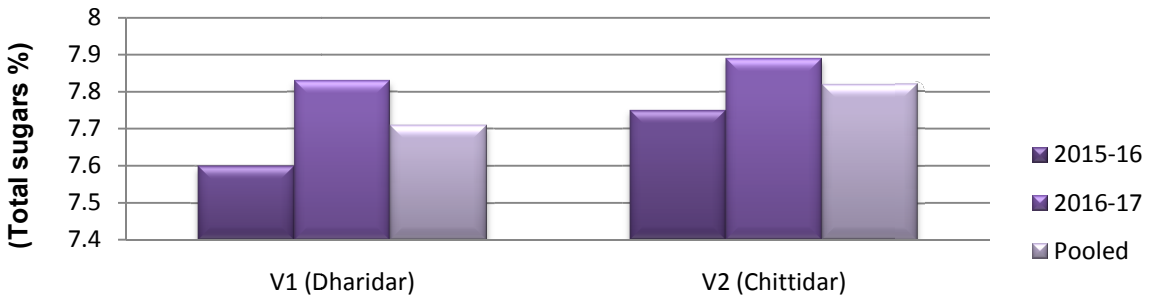

Fig. 4.112 Performance of varieties against total sugars (%) at 0 day storage

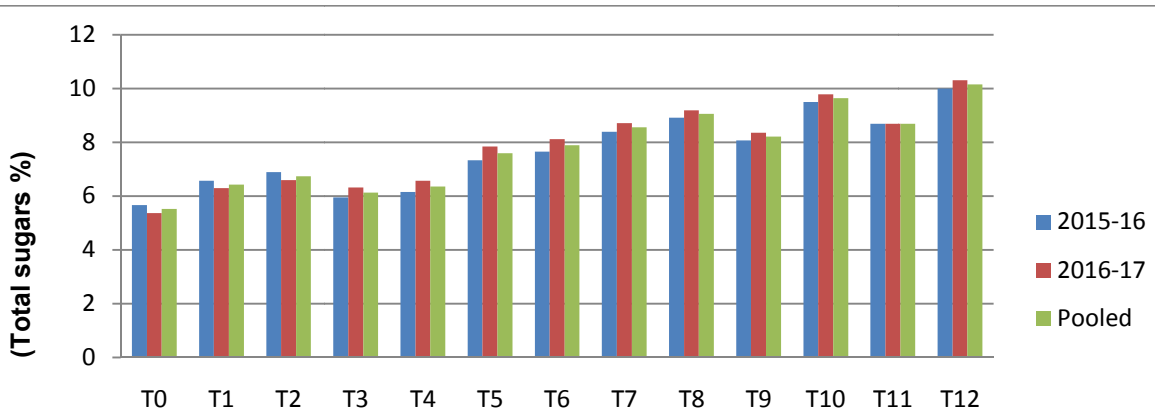

Fig. 4.113 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on total sugars (%) at 0 day storage

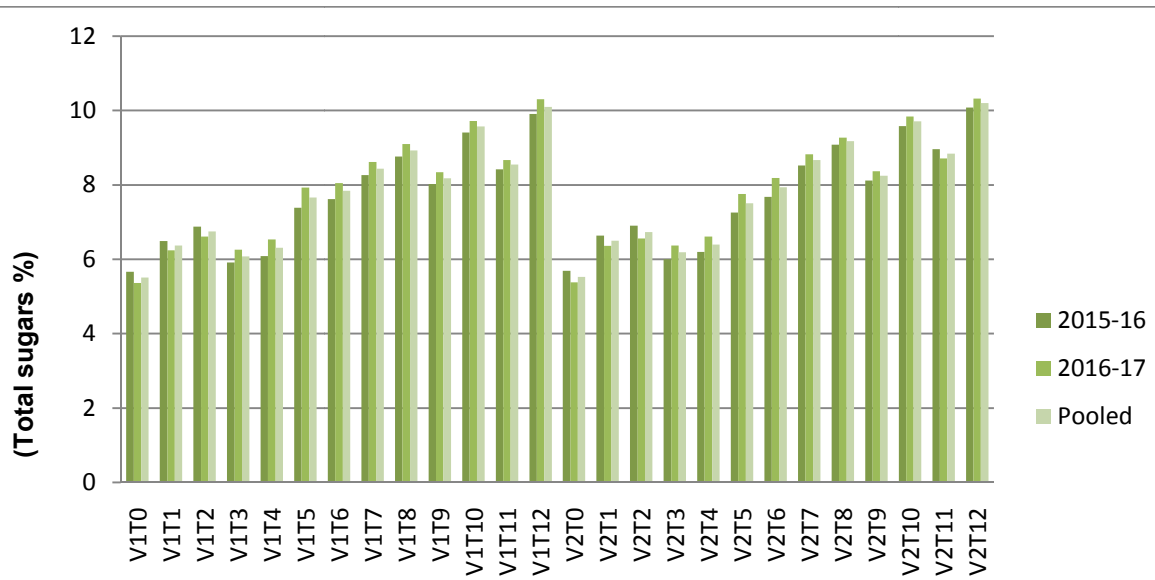

Fig. 4.114 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on total sugars (%) at 0 day storage

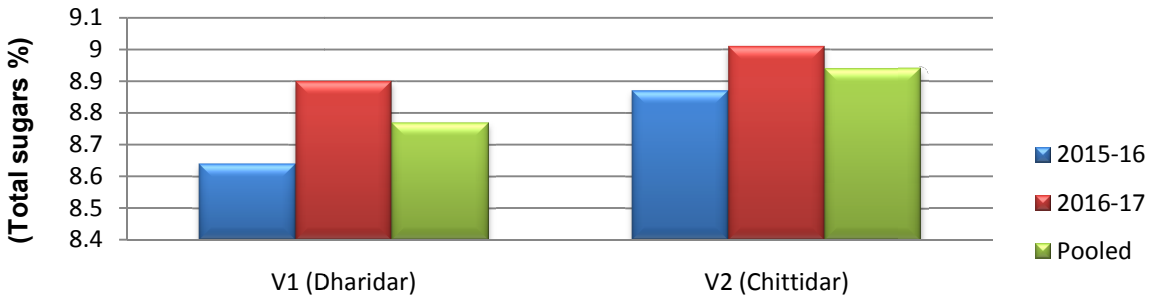

Fig. 4.115 Performance of varieties against total sugars (%) at 3 day storage

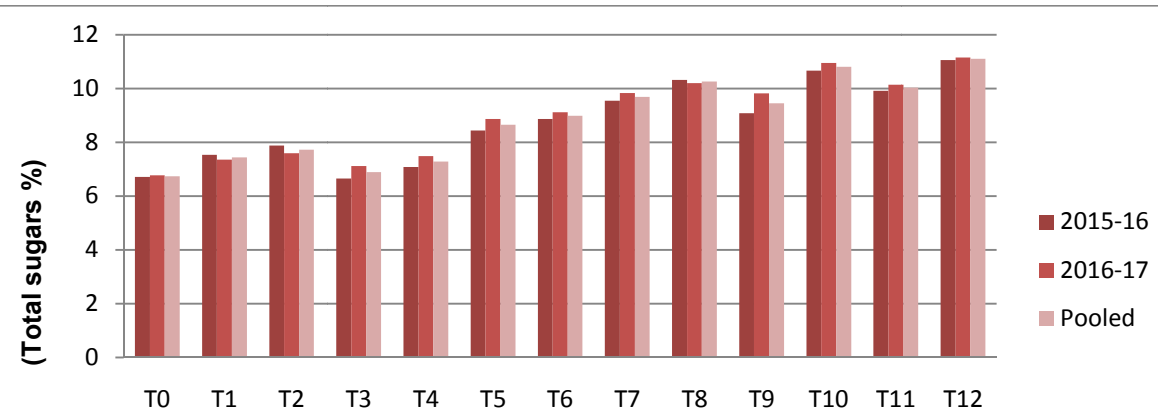

Fig. 4.116 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on total sugars (%) at 3 day storage

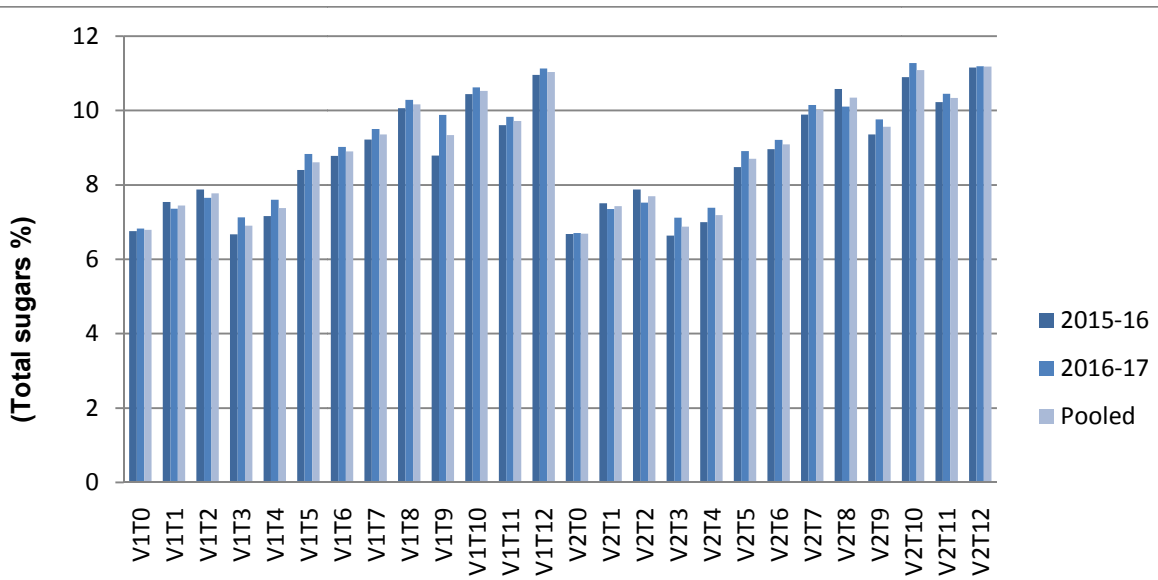

Fig. 4.117 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on total sugars (%) at 3 day storage

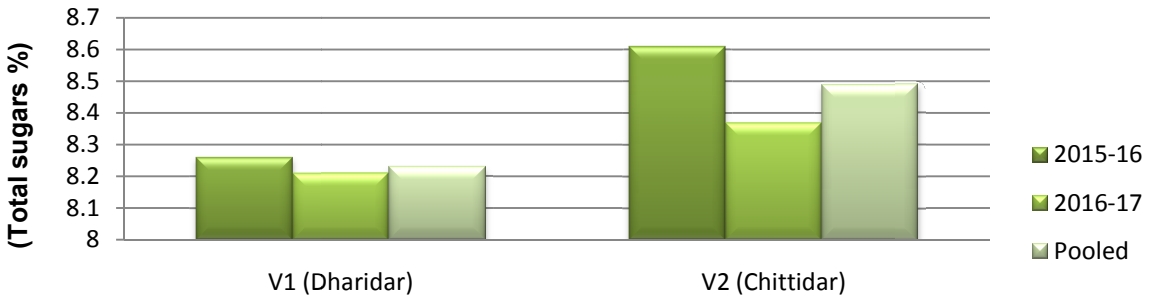

Fig. 4.118 Performance of varieties against total sugars (%) at 6 day storage

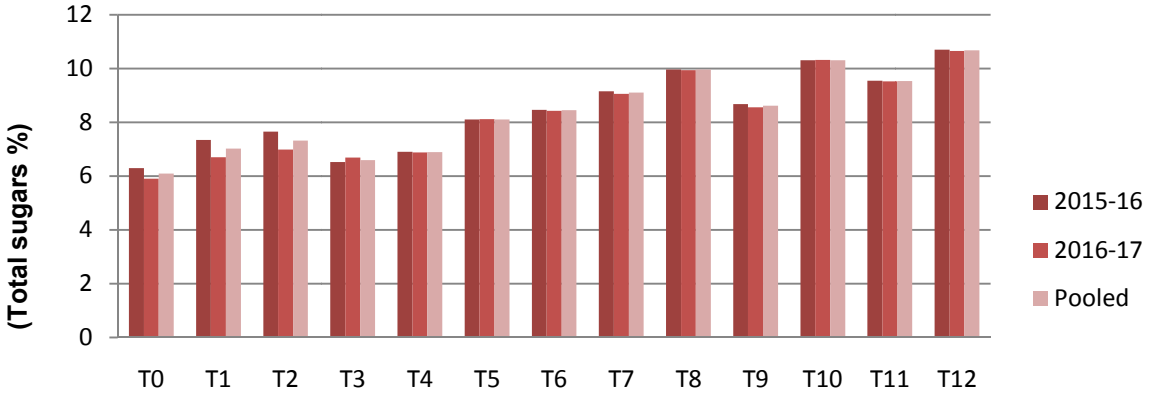

Fig. 4.119 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on total sugars (%) at 6 day storage

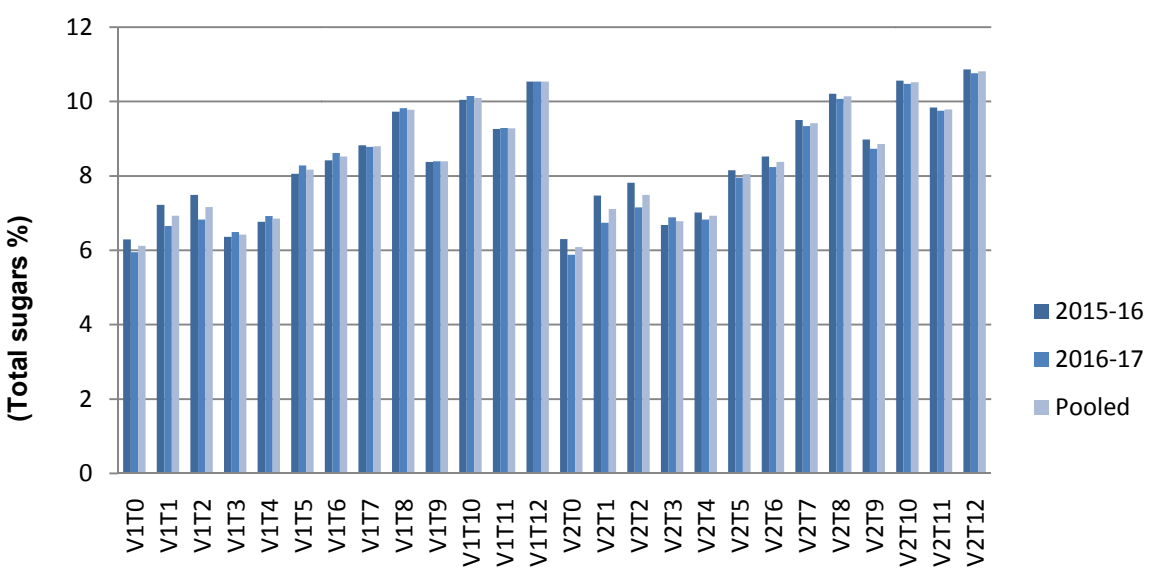

Fig. 4.120 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on total sugars (%) at 6 day storage

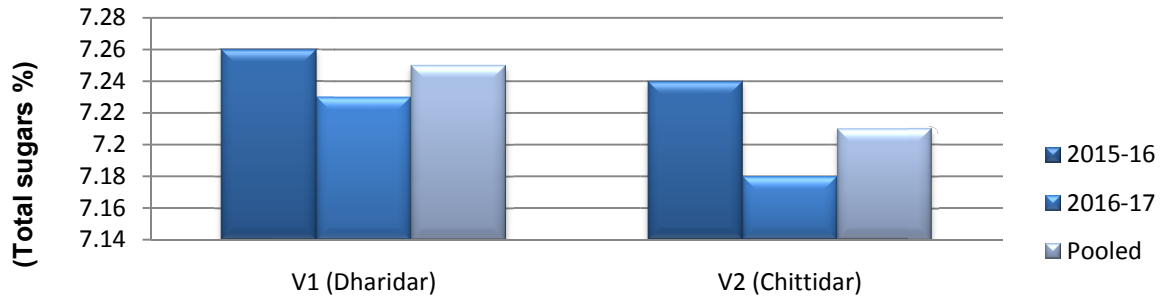

Fig. 4.121 Performance of varieties against total sugars (%) at 9 day storage

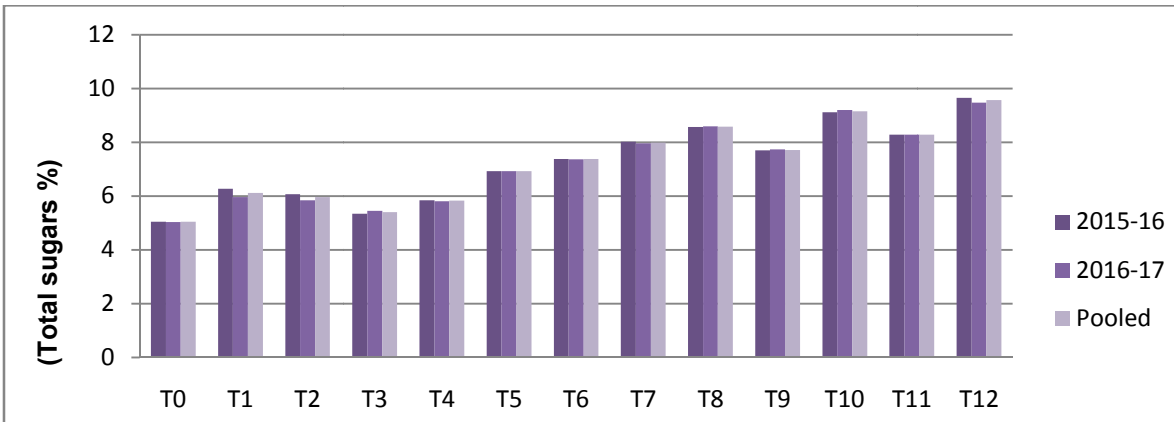

Fig. 4.122 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on total sugars (%) at 9 day storage

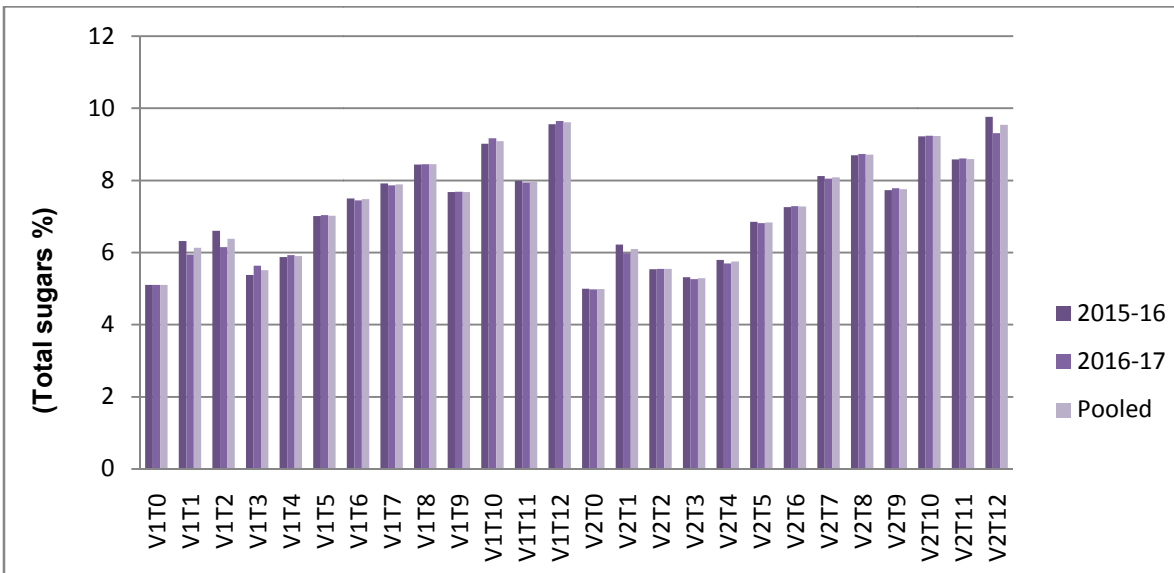

Fig. 4.123 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on total sugars (%) at 9 day storage

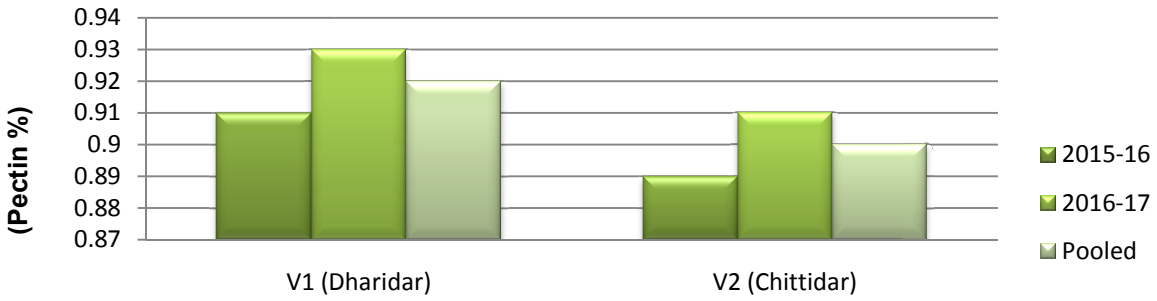

Fig. 4.124 Performance of varieties against pectin (%) at 0 day storage

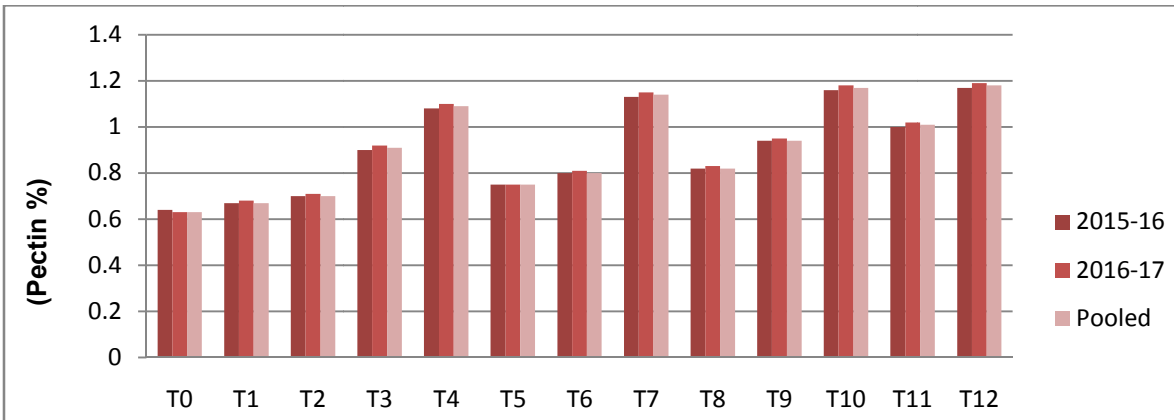

Fig. 4.125 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on pectin (%) at 0 day storage

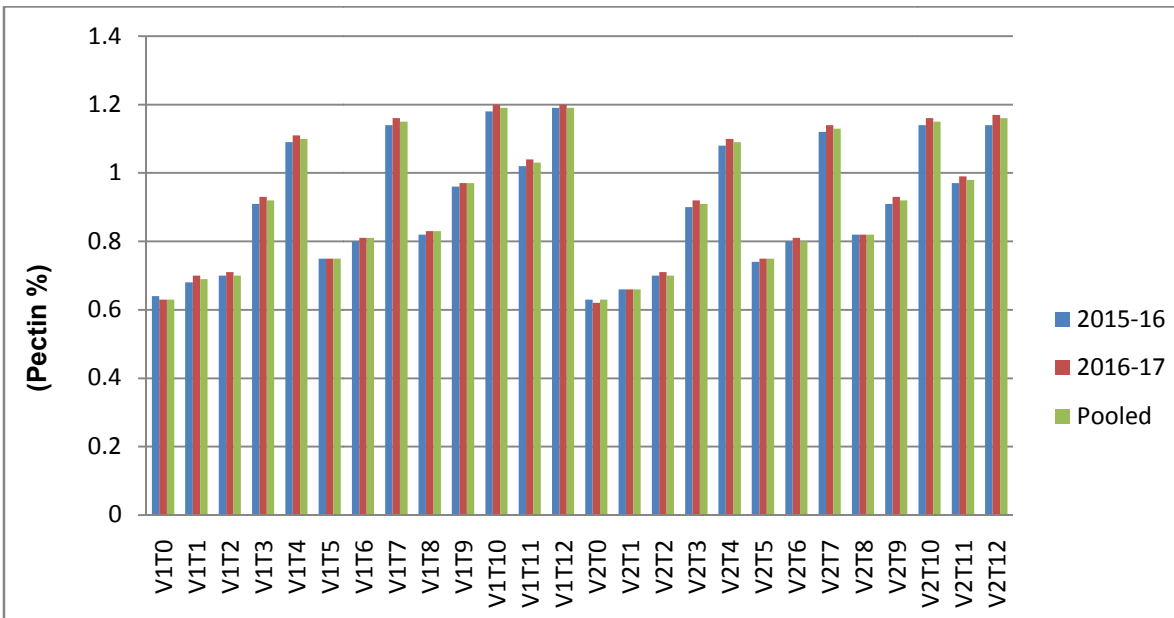

Fig. 4.126 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on pectin (%) at 0 day storage

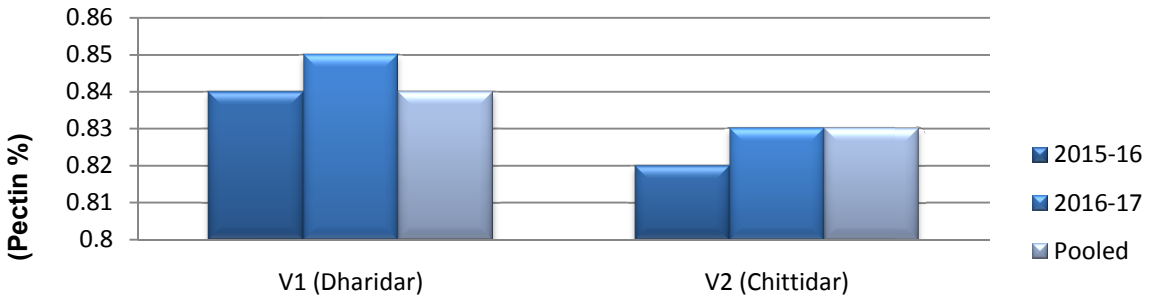

Fig. 4.127 Performance of varieties against pectin (%) at 3 day storage

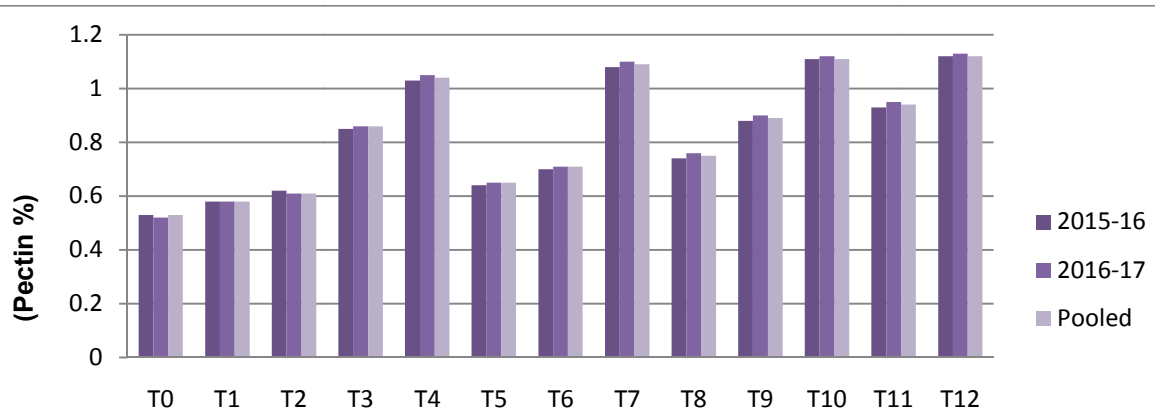

Fig. 4.128 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on pectin (%) at 3 day storage

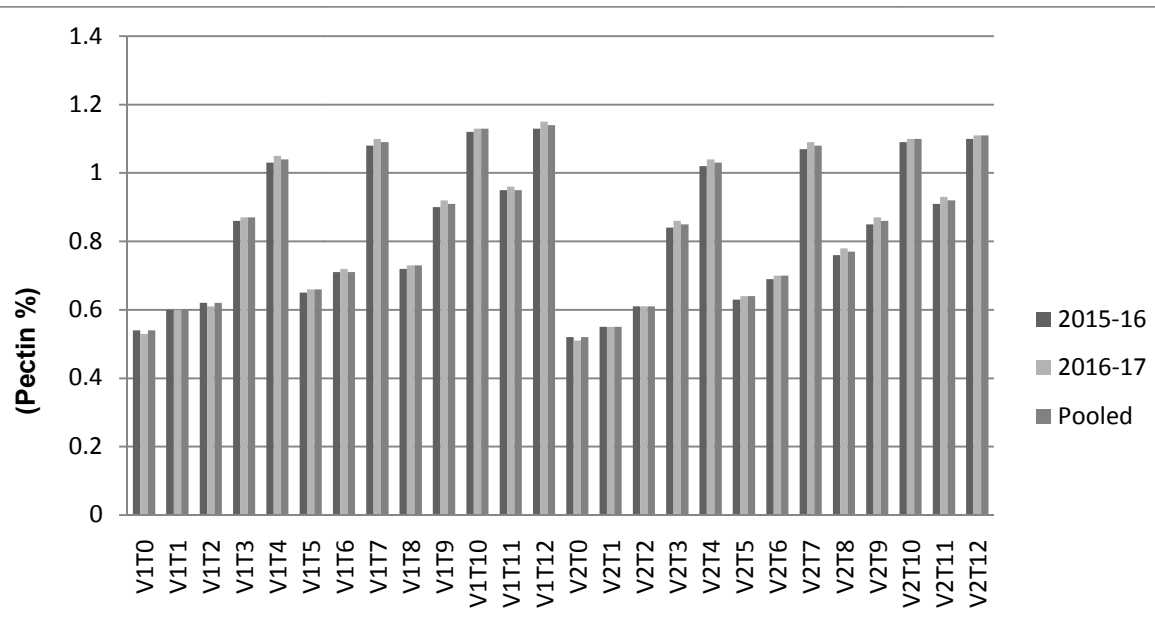

Fig. 4.129 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on pectin (%) at 3 day storage

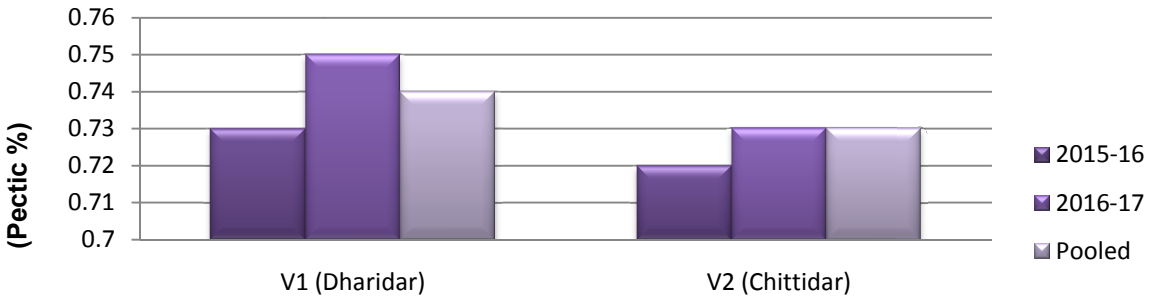

Fig. 4.130 Performance of varieties against pectin (%) at 6 day storage

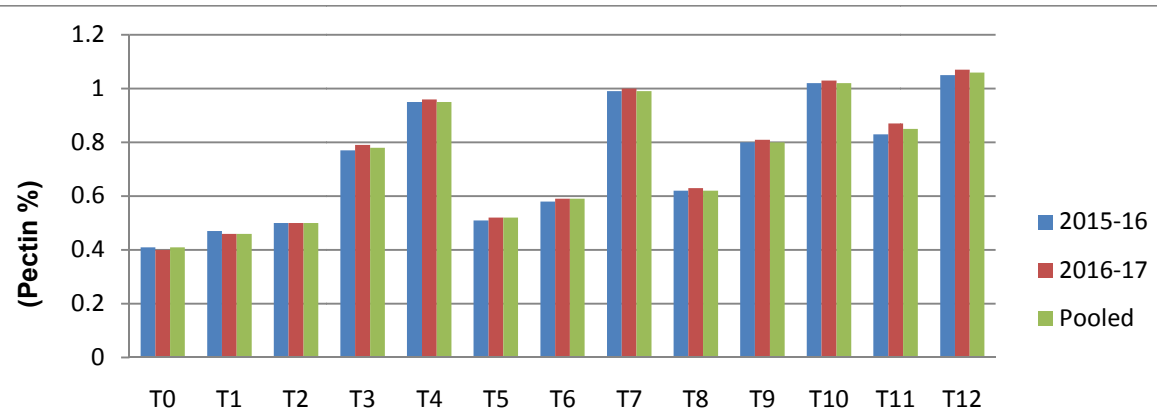

Fig. 4.131 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on pectin (%) at 6 day storage

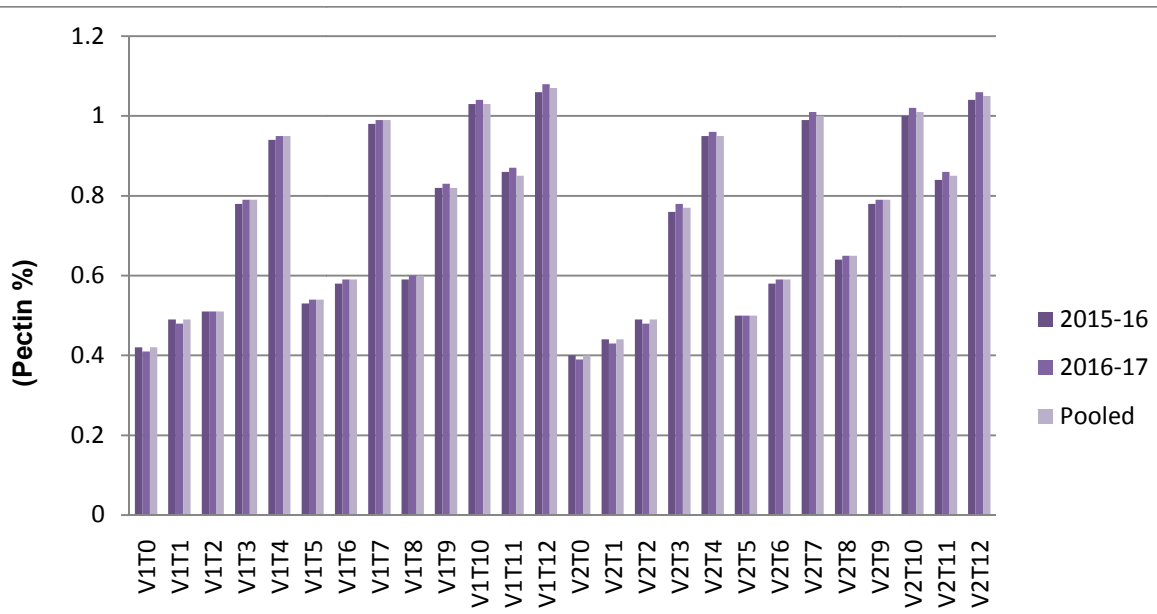

Fig. 4.132 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on pectin (%) at 6 day storage

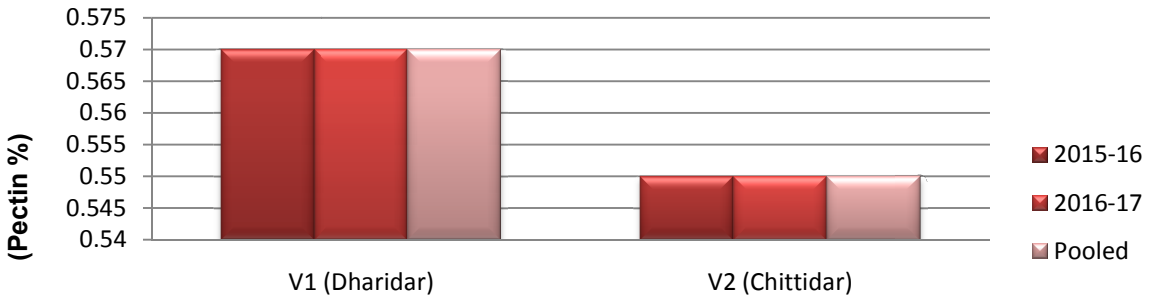

Fig. 4.133 Performance of varieties against pectin (%) at 9 day storage

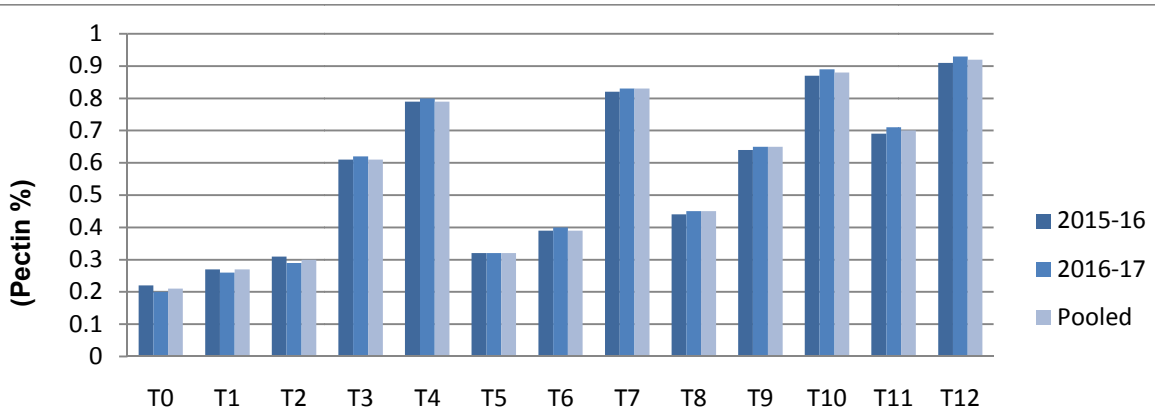

Fig. 4.134 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on pectin (%) at 9 day storage

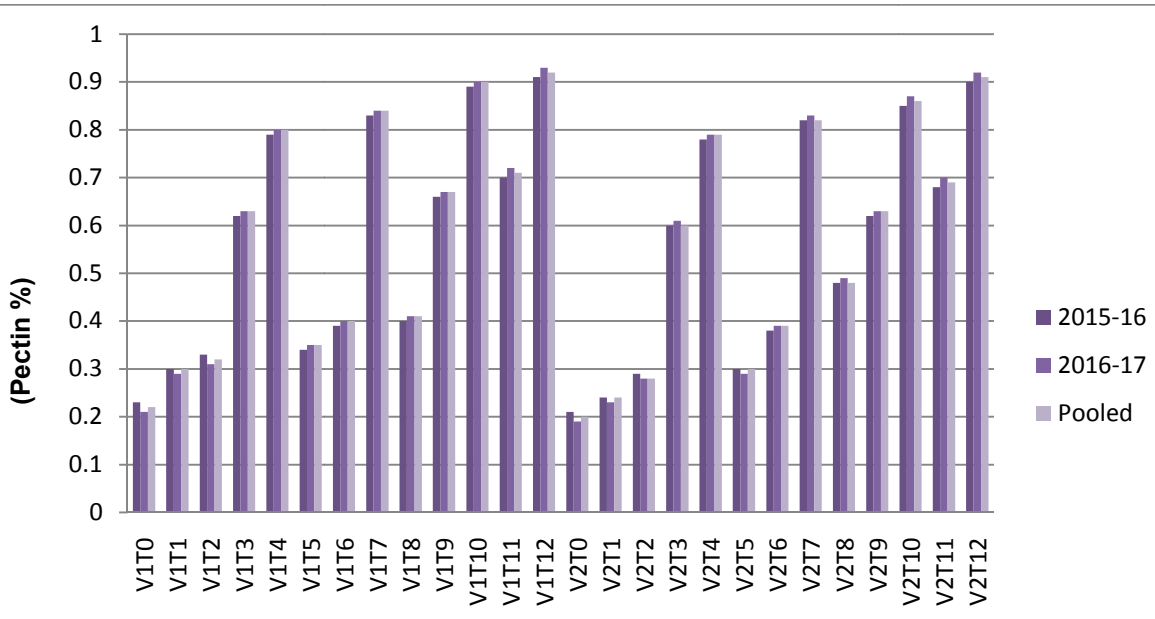

Fig. 4.135 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on pectin (%) at 9 day storage

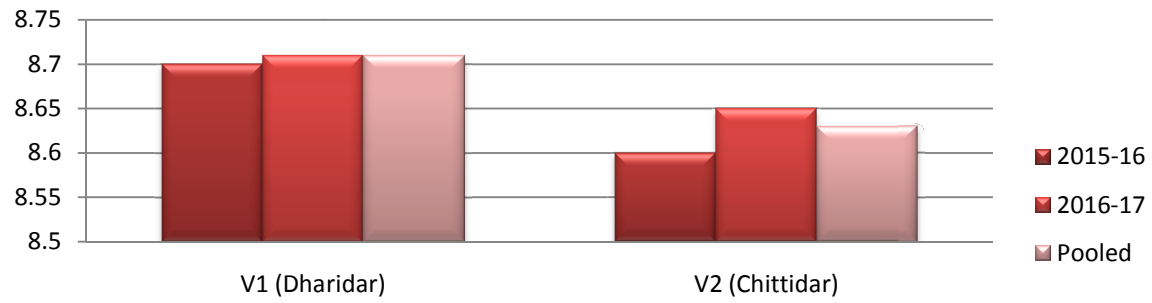

Fig. 4.136 Performance of varieties against appearance at 0 day storage

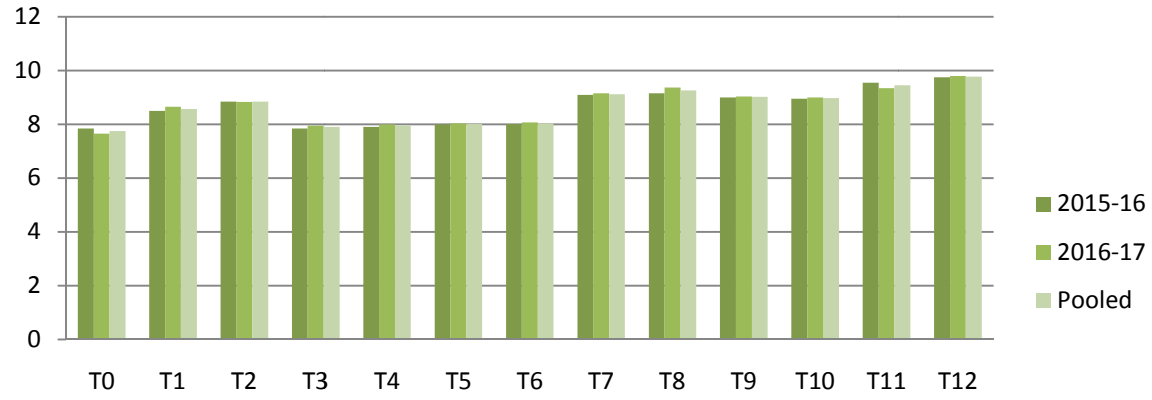

Fig. 4.137 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on appearance at 0 day storage

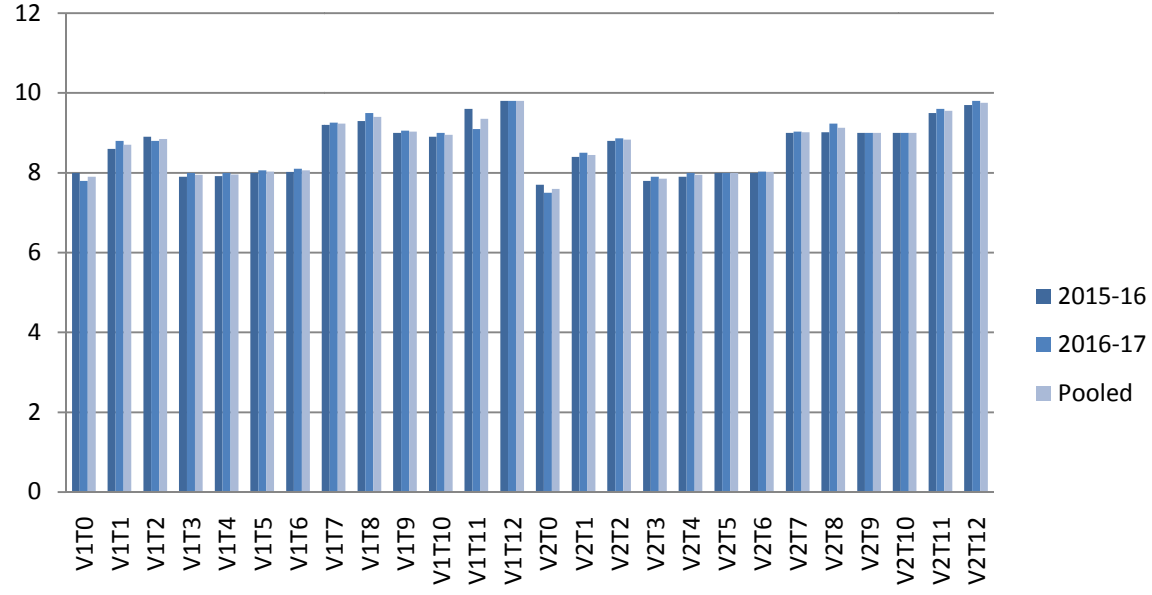

Fig. 4.138 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on appearance at 0 day storage

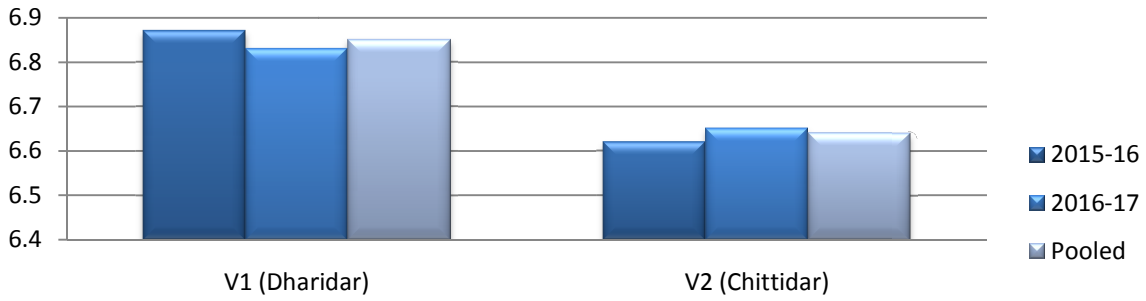

Fig. 4.139 Performance of varieties against appearance at 3 day storage

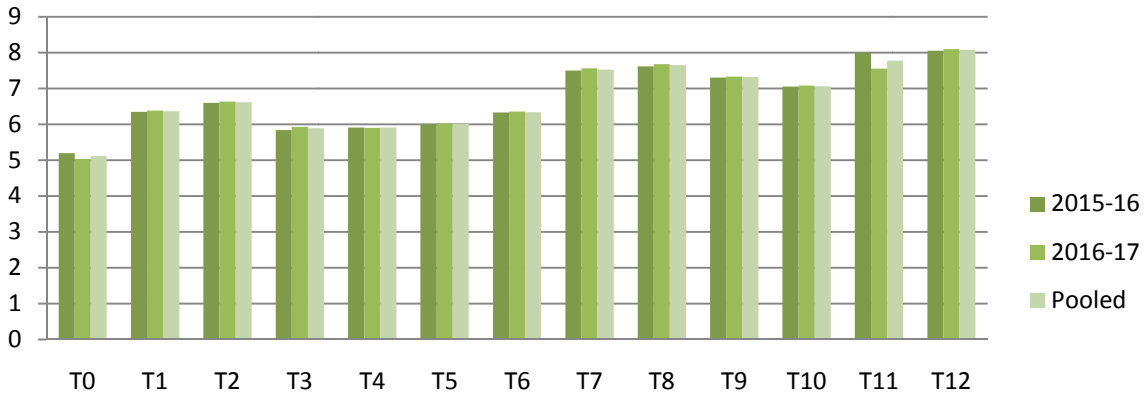

Fig. 4.140 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on appearance at 3 day storage

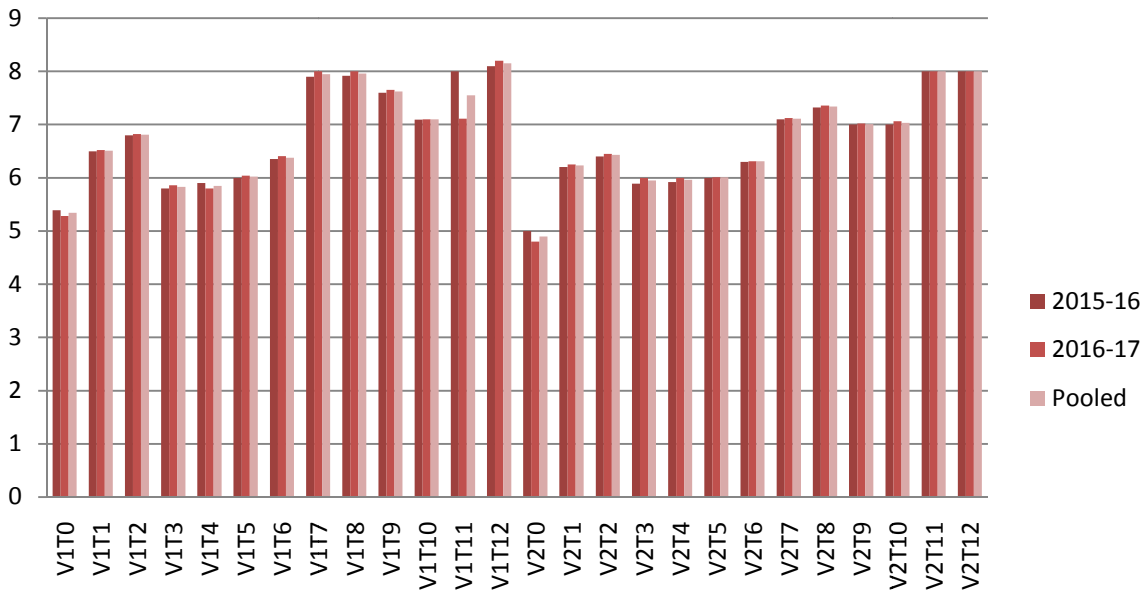

Fig. 4.141 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on appearance at 3 day storage

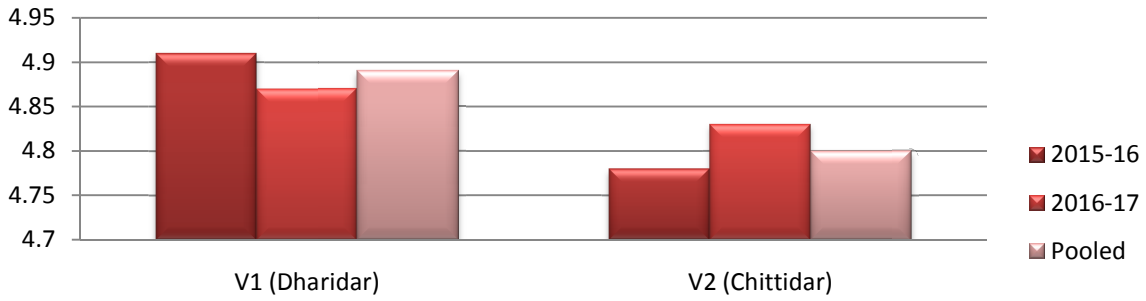

Fig. 4.142 Performance of varieties against appearance at 6 day storage

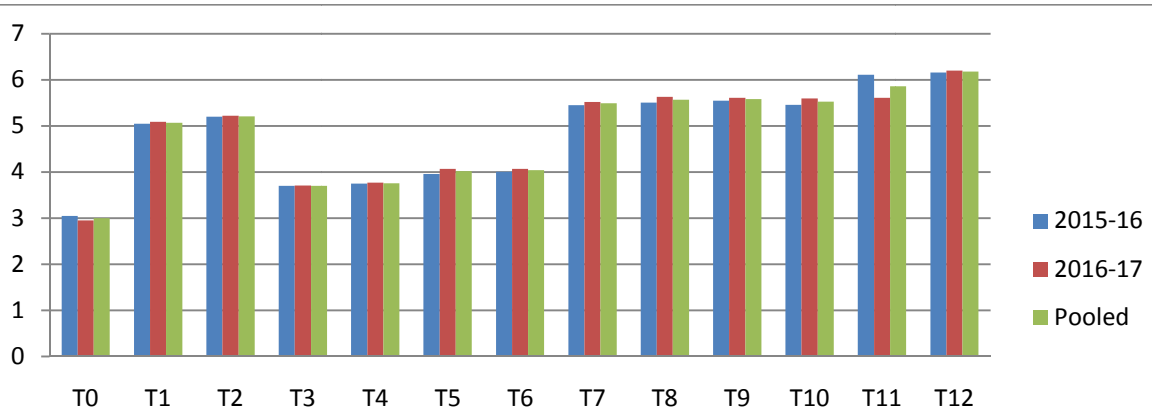

Fig. 4.143 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on appearance at 6 day storage

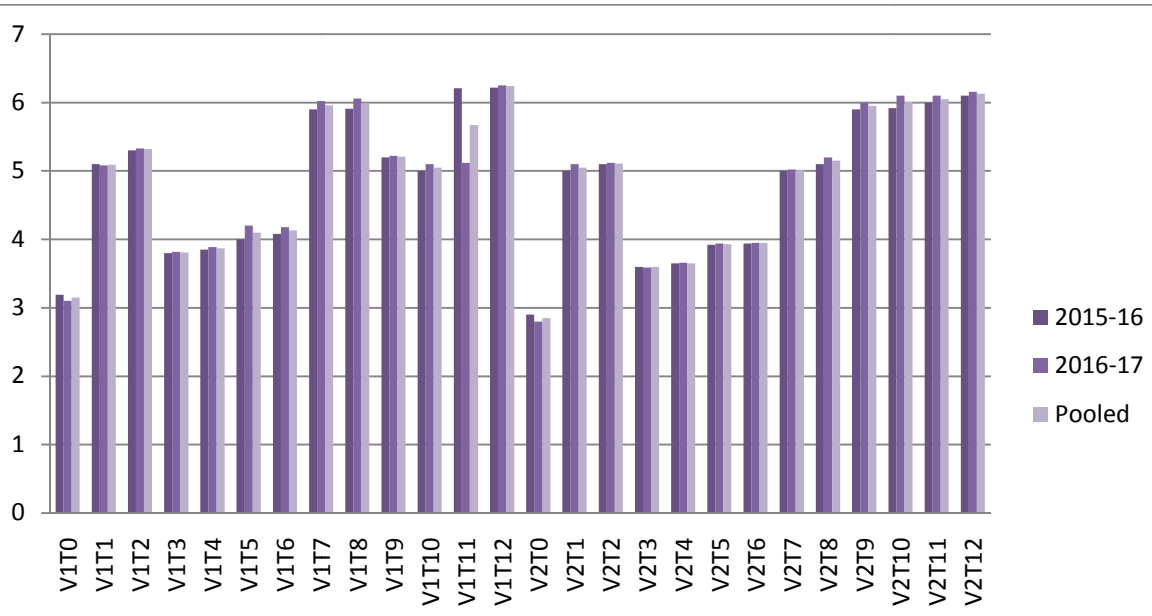

Fig. 4.144 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on appearance at 6 day storage

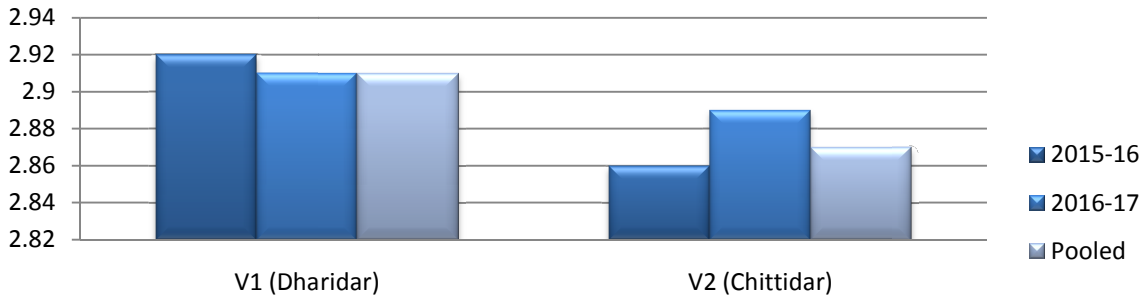

Fig. 4.145 Performance of varieties against appearance at 9 day storage

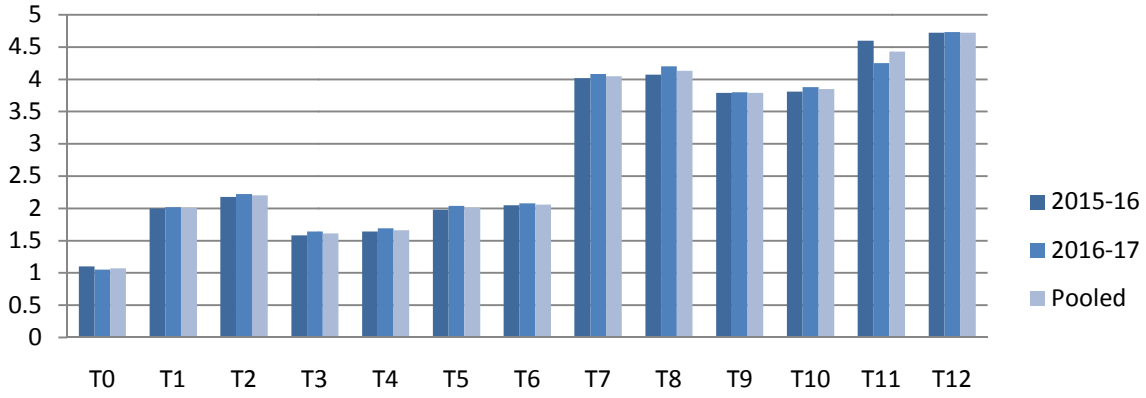

Fig. 4.146 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on appearance at 9 day storage

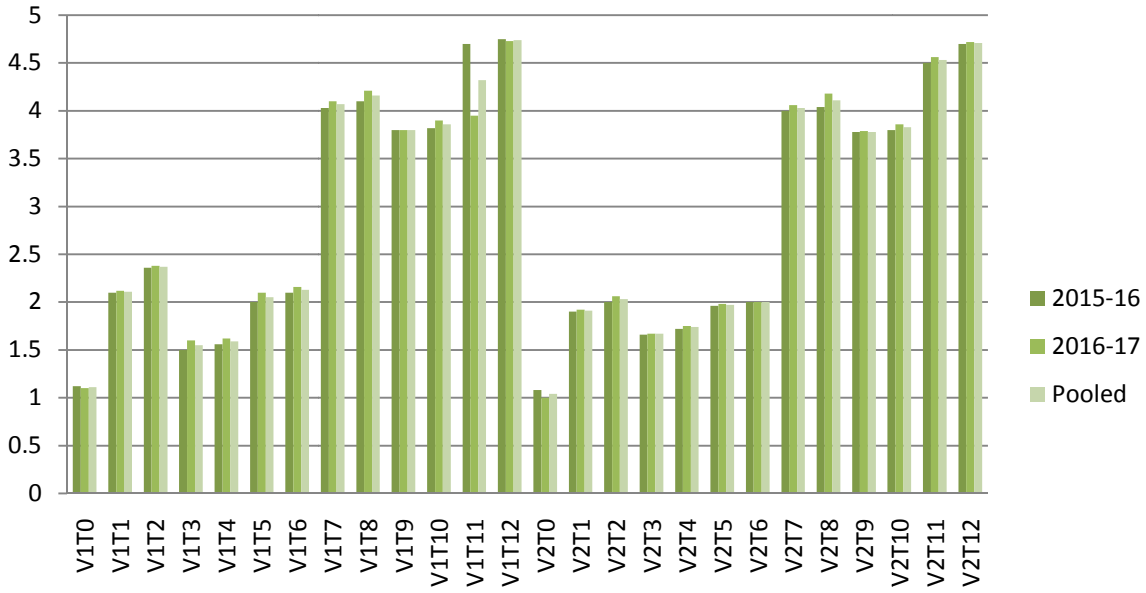

Fig. 4.147 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on appearance at 9 day storage

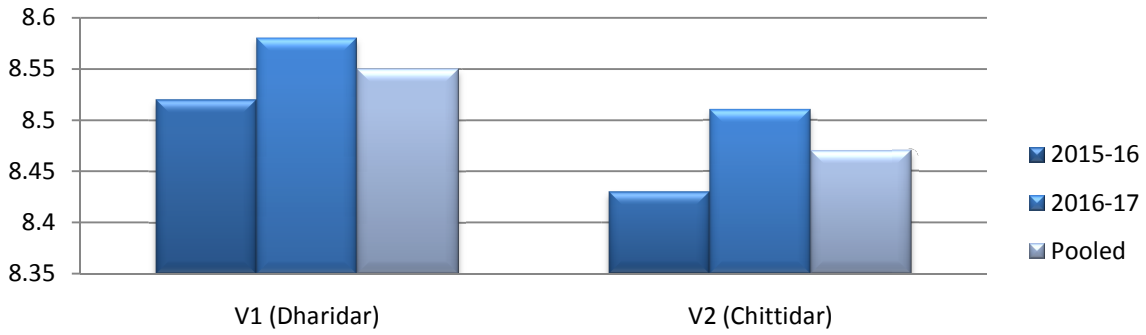

Fig. 4.148 Performance of varieties against taste at 0 day storage

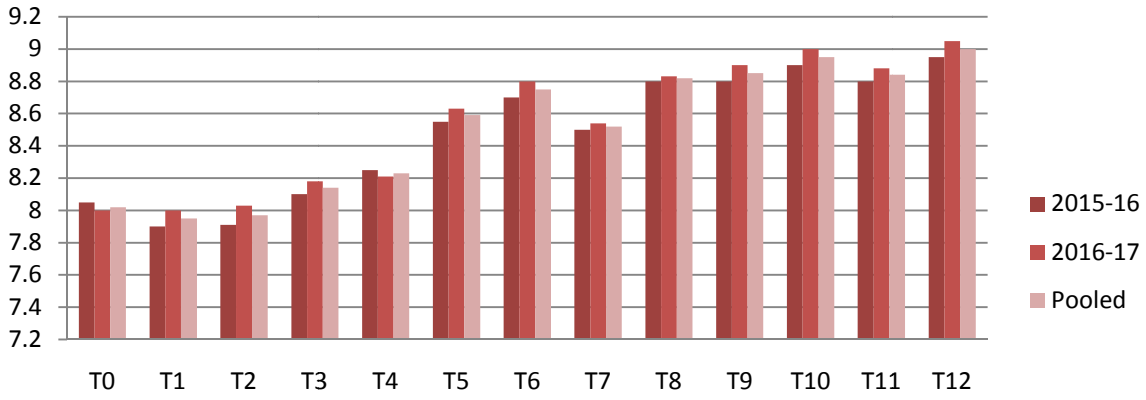

Fig. 4.149 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on taste at 0 day storage

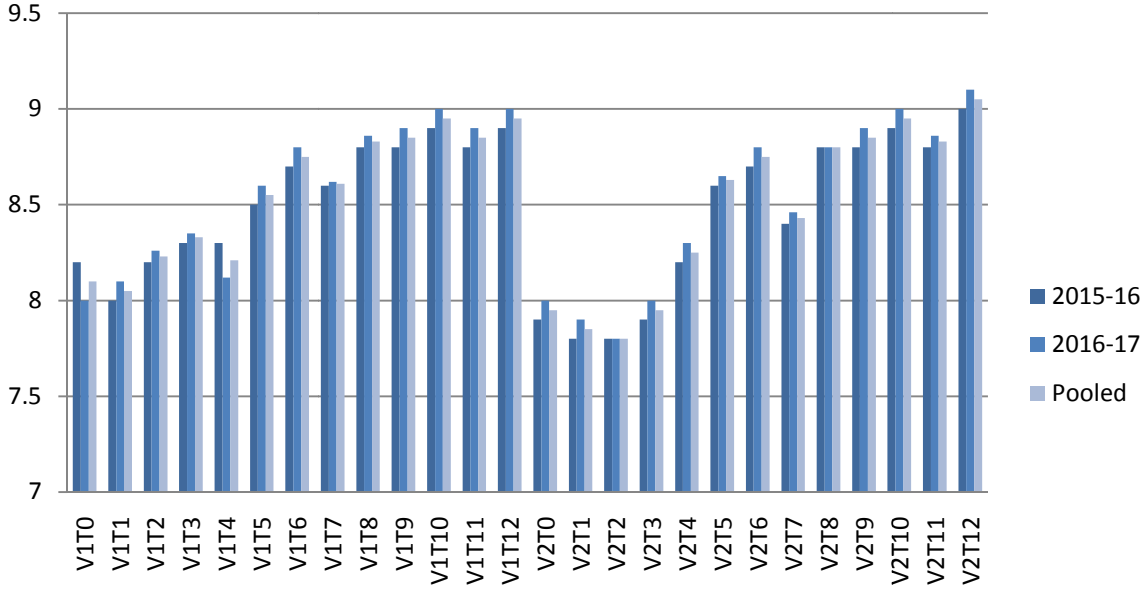

Fig. 4.150 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on taste at 0 day storage

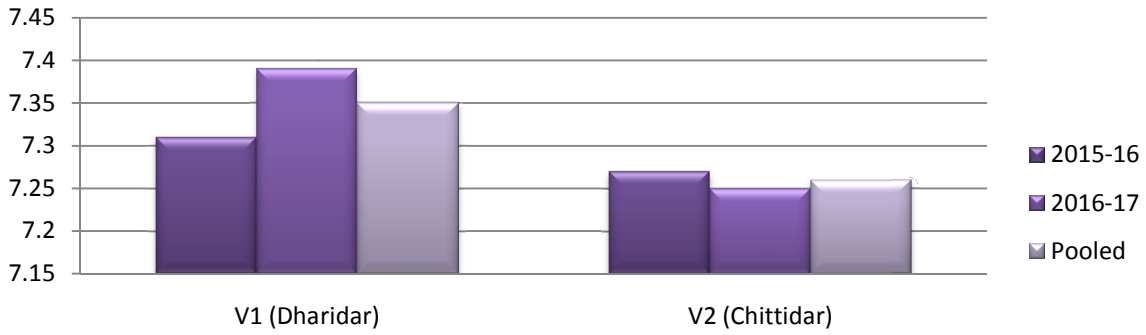

Fig. 4.151 Performance of varieties against taste at 3 day storage

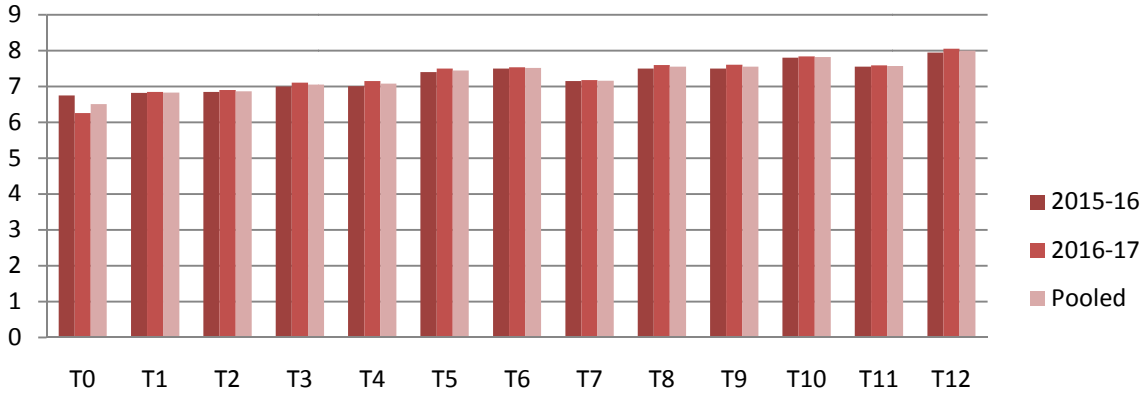

Fig. 4.152 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on taste at 3 day storage

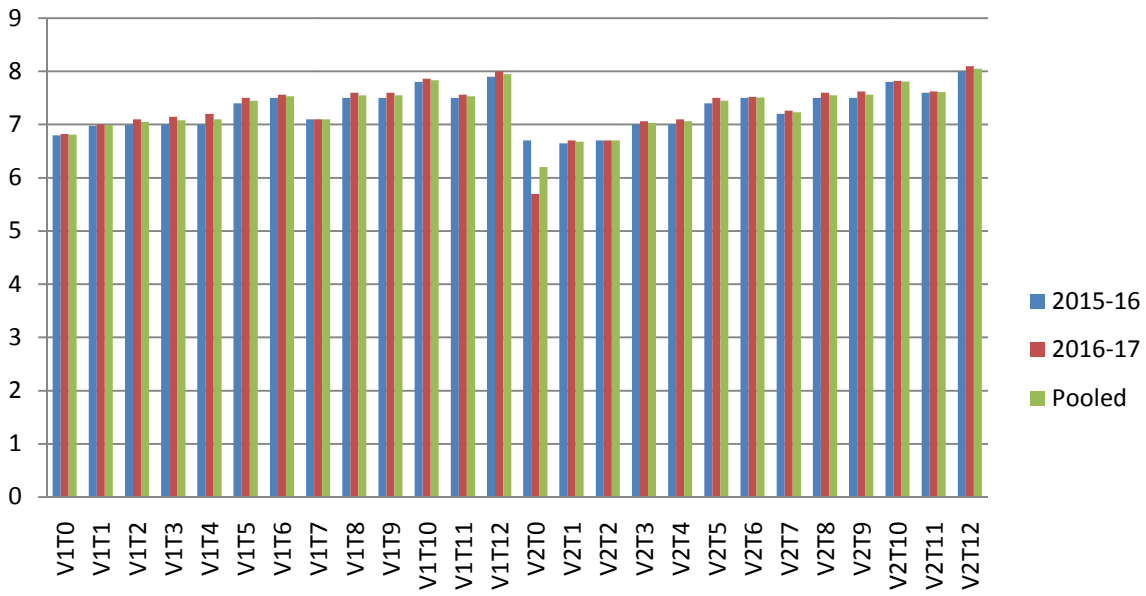

Fig. 4.153 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on taste at 3 day storage

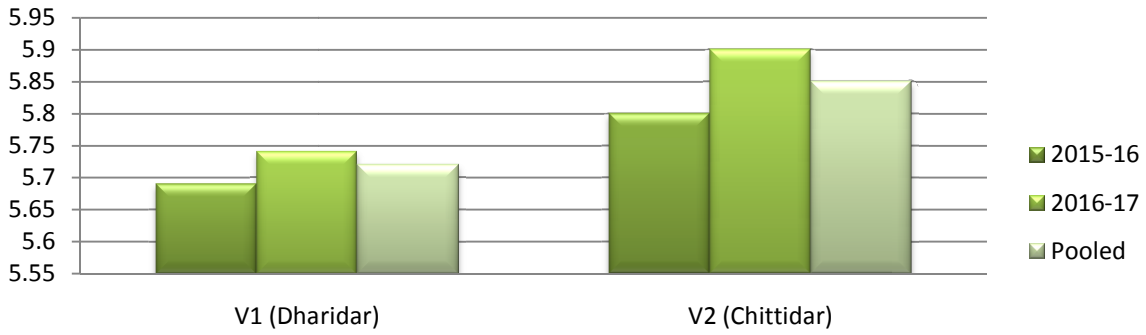

Fig. 4.154 Performance of varieties against taste at 6 day storage

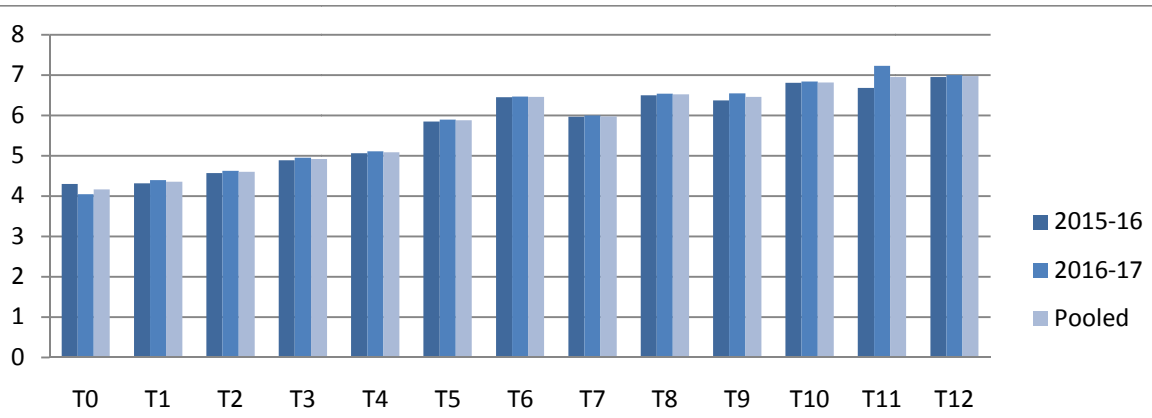

Fig. 4.155 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on taste at 6 day storage

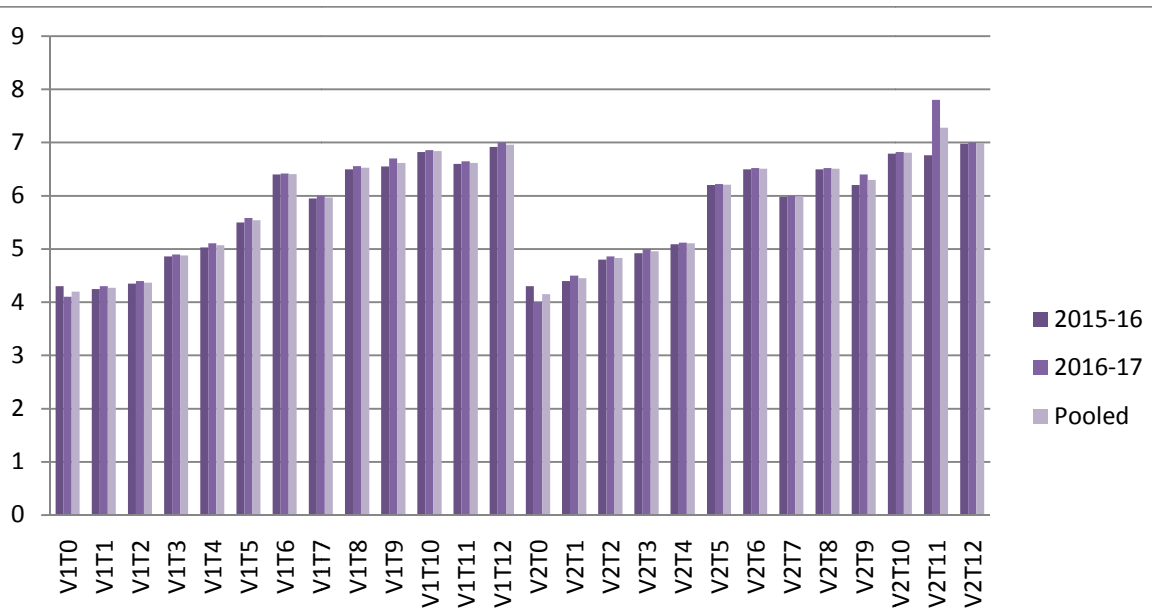

Fig. 4.156 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on taste at 6 day storage

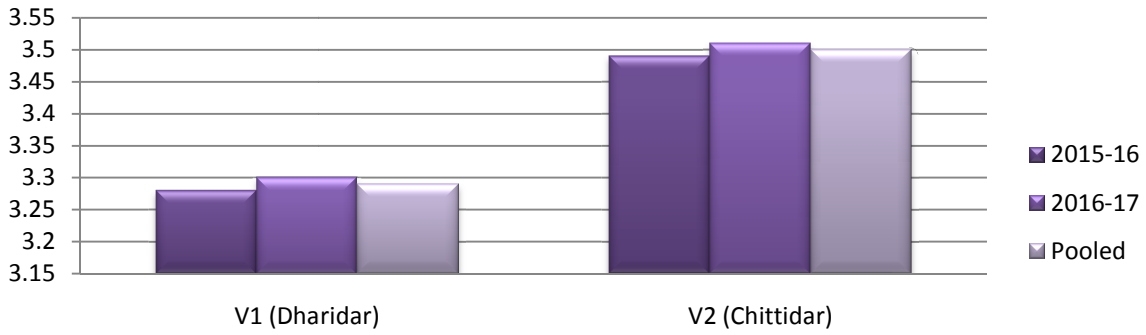

Fig. 4.157 Performance of varieties against taste at 9 day storage

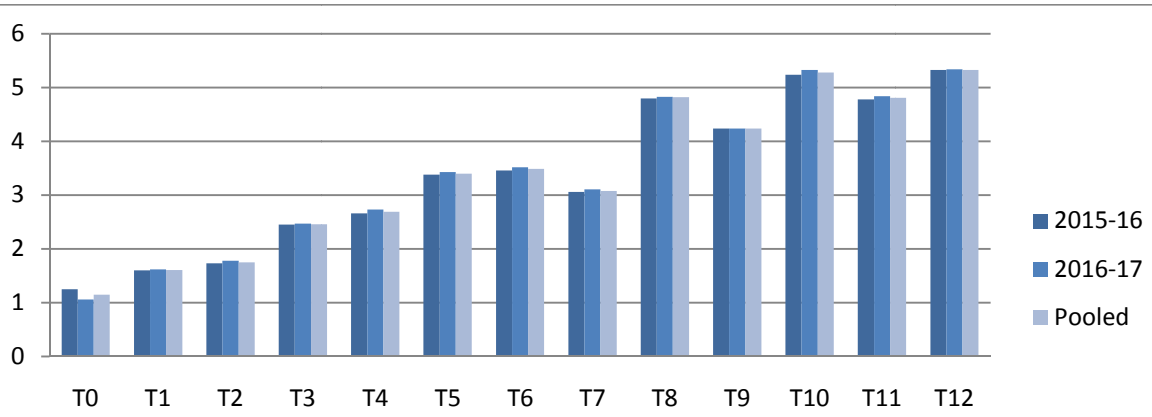

Fig. 4.158 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on taste at 9 day storage

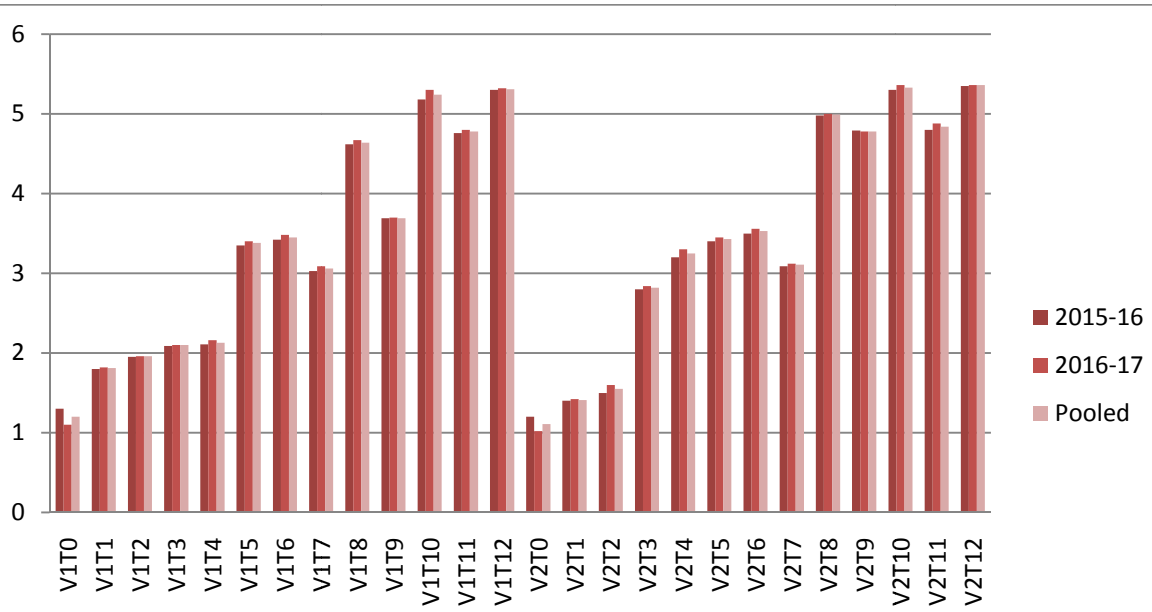

Fig. 4.159 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on taste at 9 day storage

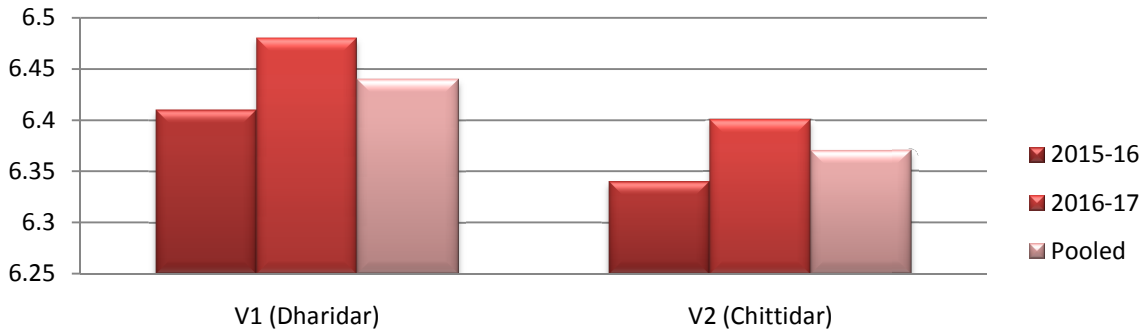

Fig. 4.160 Performance of varieties against flavour at 0 day storage

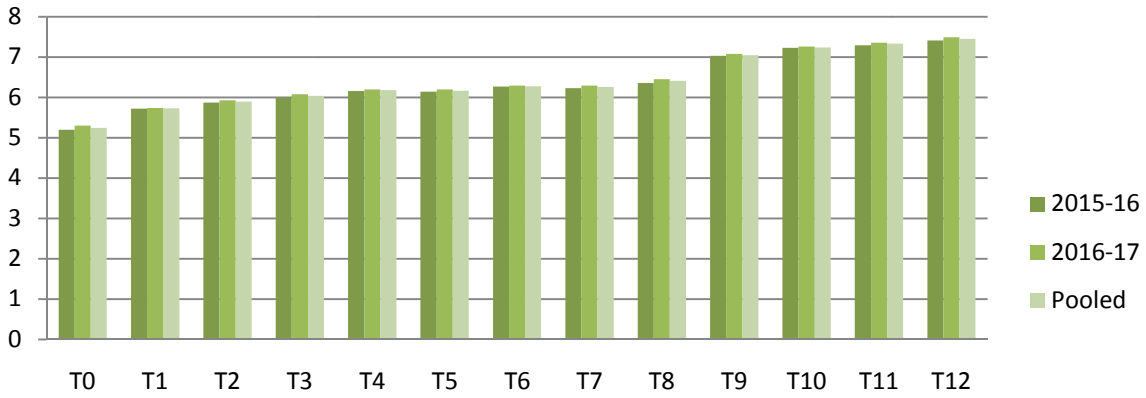

Fig. 4.161 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on flavour at 0 day storage

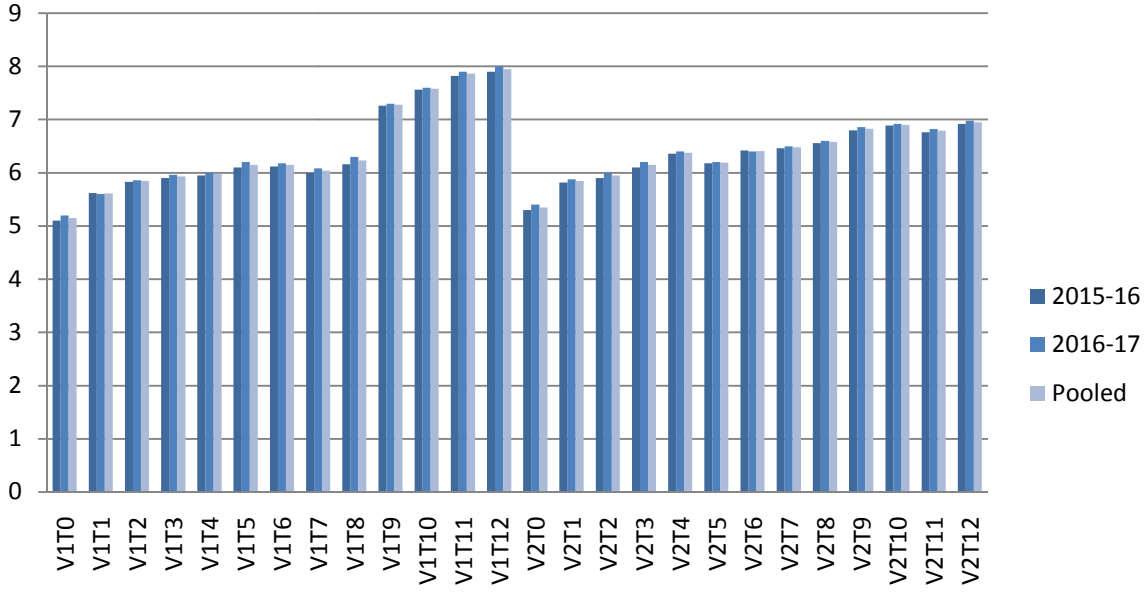

Fig. 4.162 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on flavour at 0 day storage

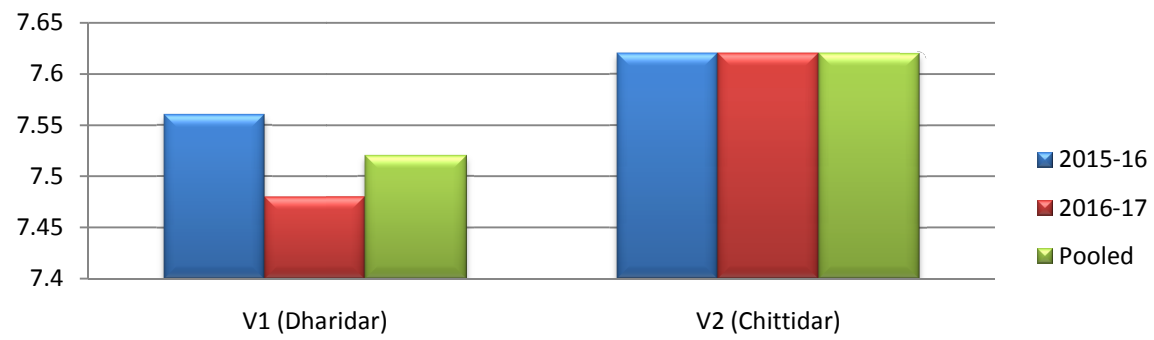

Fig. 4.163 Performance of varieties against flavour at 3 day storage

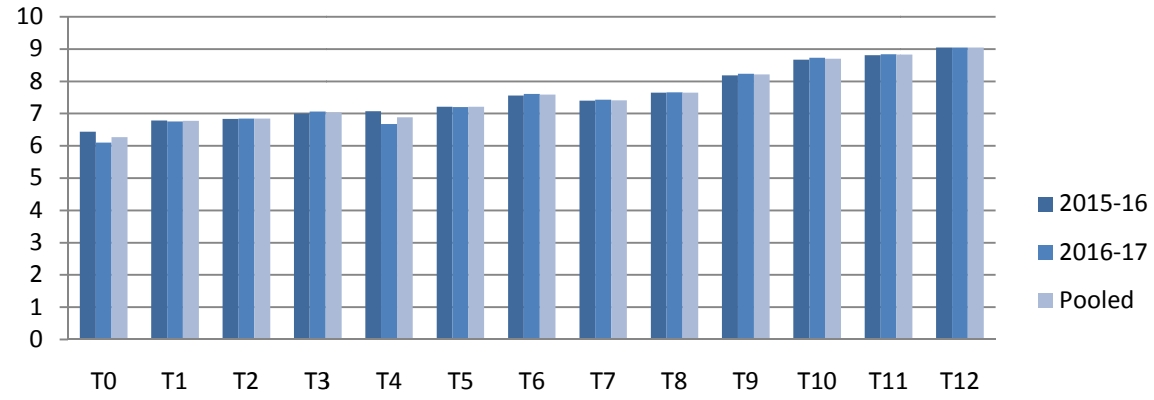

Fig. 4.164 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on flavour at 3 day storage

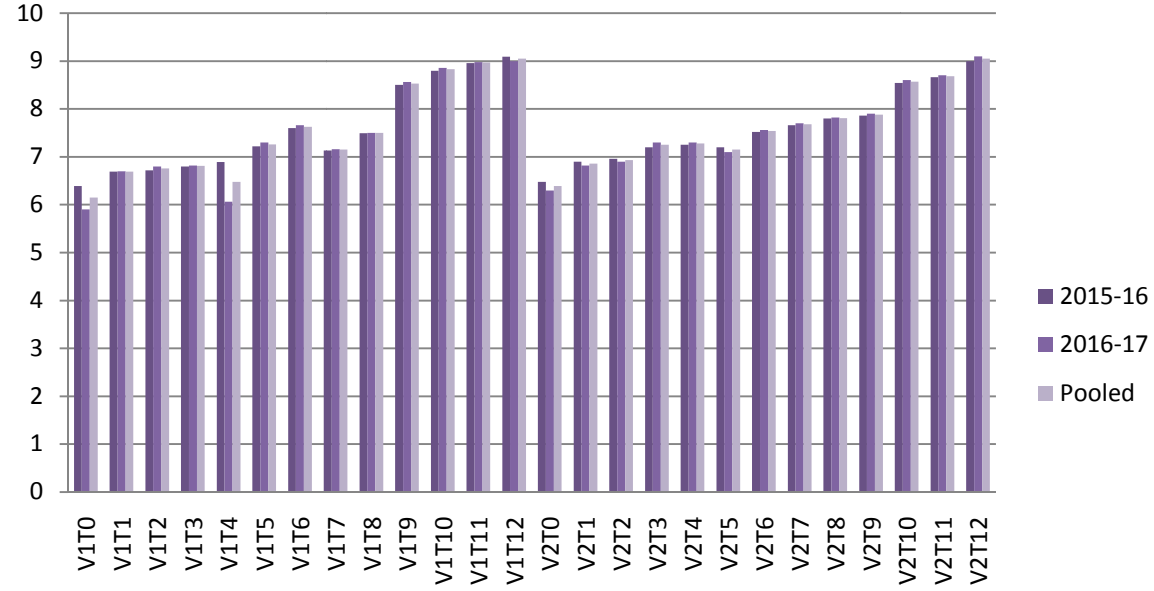

Fig. 4.165 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on flavour at 3 day storage

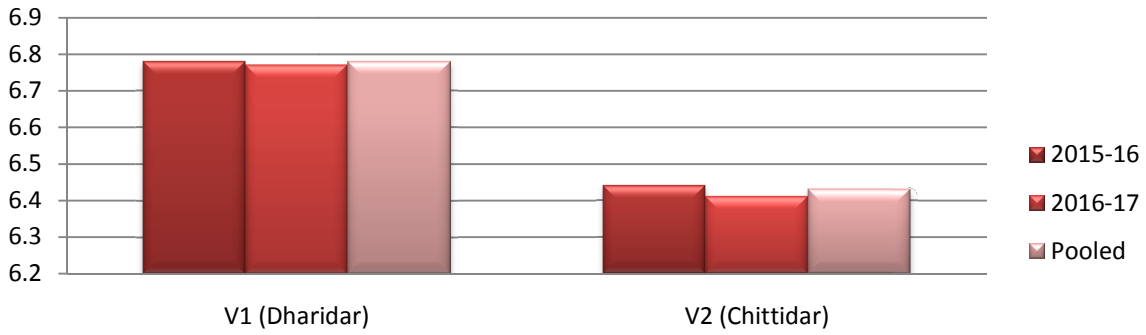

Fig. 4.166 Performance of varieties against flavour at 6 day storage

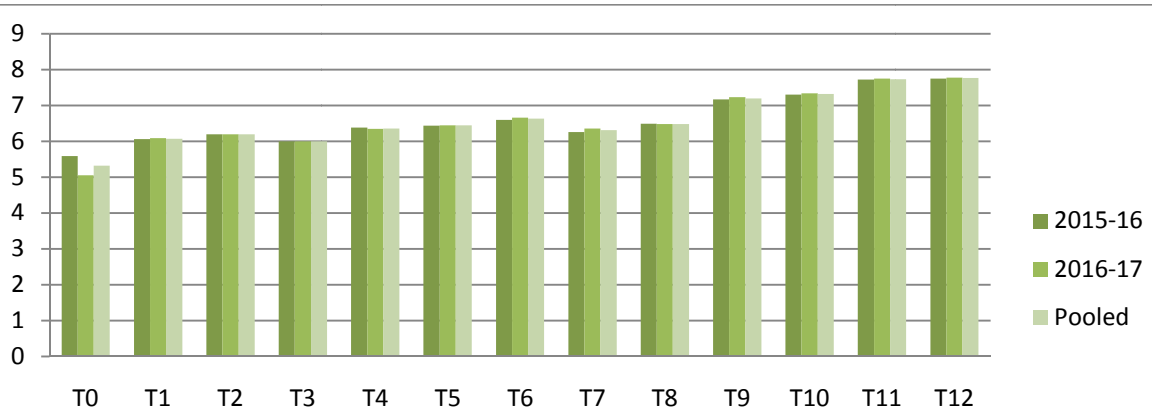

Fig. 4.167 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on flavour at 6 day storage

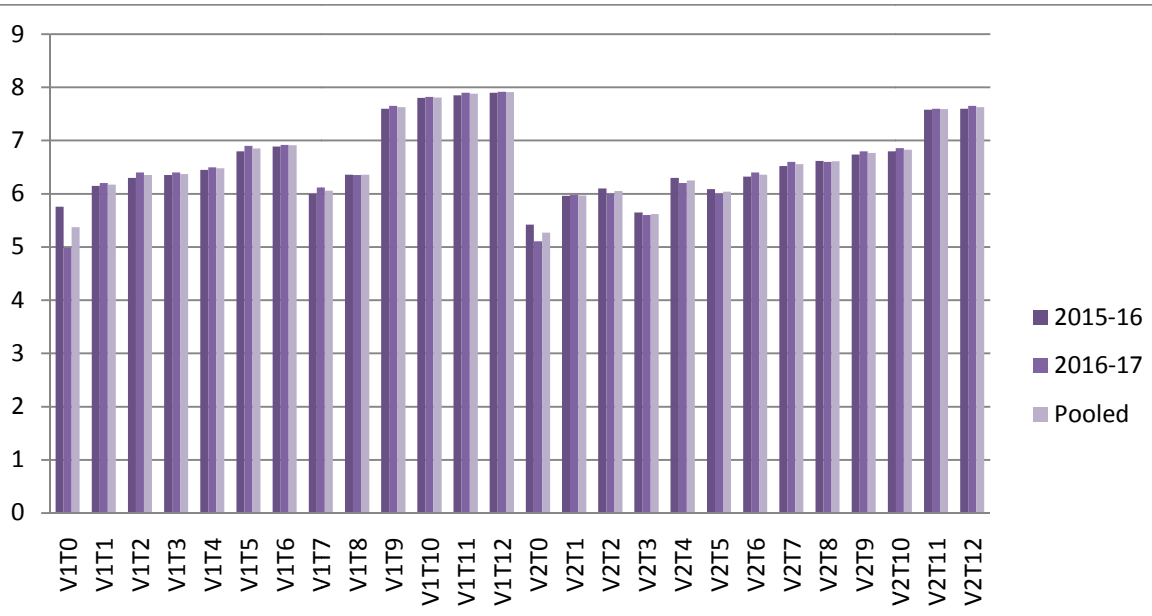

Fig. 4.168 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on flavour at 6 day storage

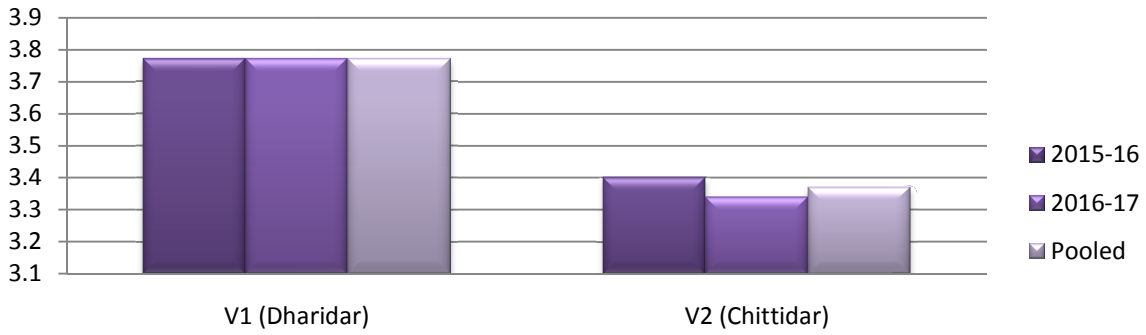

Fig. 4.169 Performance of varieties against flavour at 9 day storage

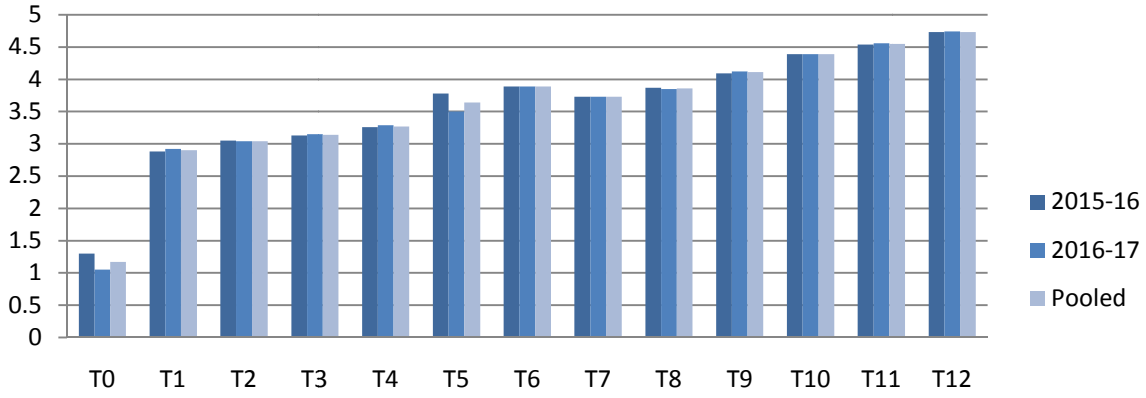

Fig. 4.170 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on flavour at 9 day storage

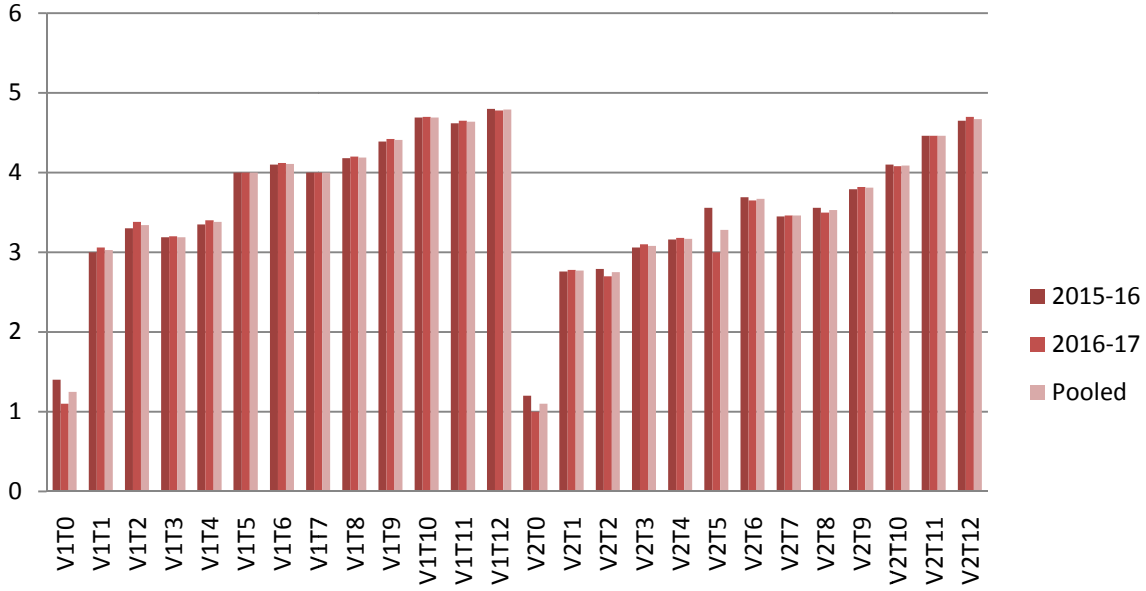

Fig. 4.171 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on flavour at 9 day storage

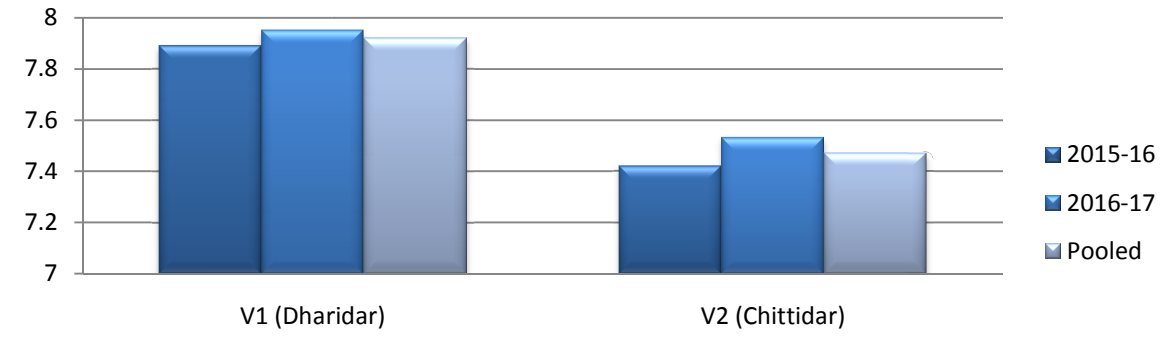

Fig. 4.172 Performance of varieties against texture at 0 day storage

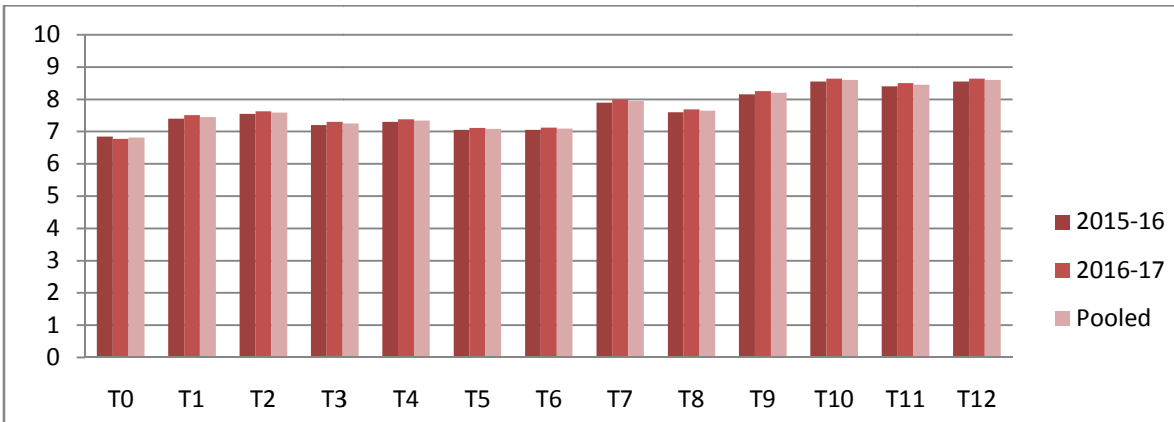

Fig. 4.173 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on texture at 0 day storage

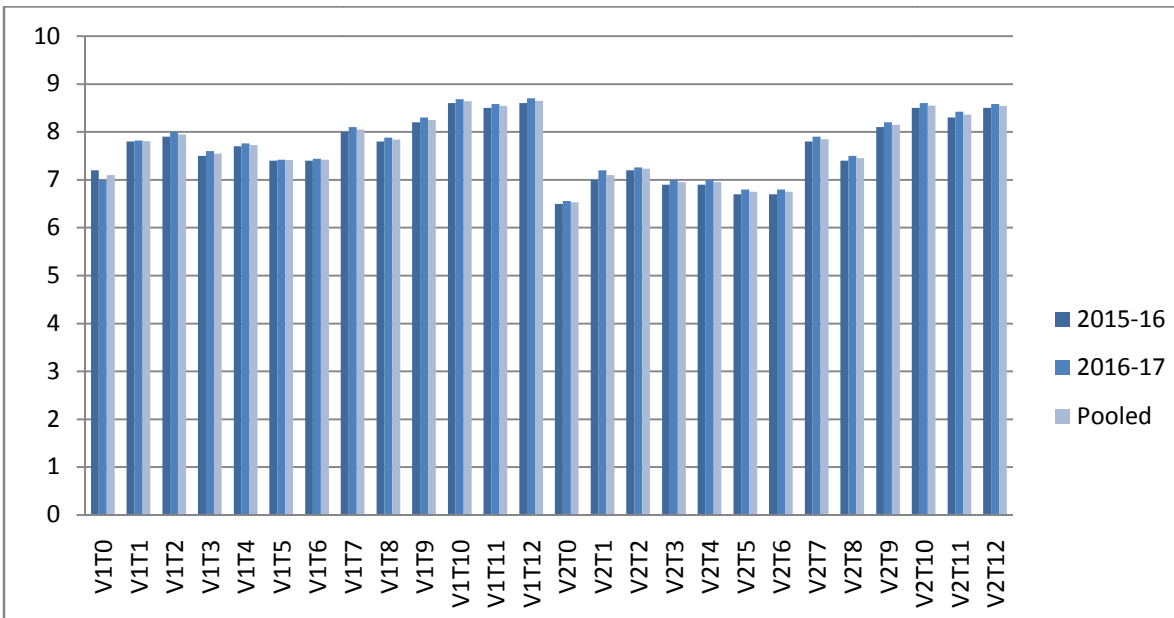

Fig. 4.174 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on texture at 0 day storage

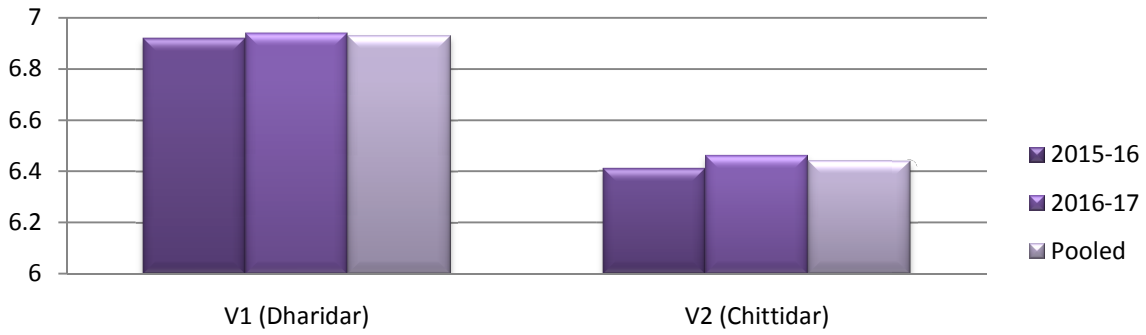

Fig. 4.175 Performance of varieties against texture at 3 day storage

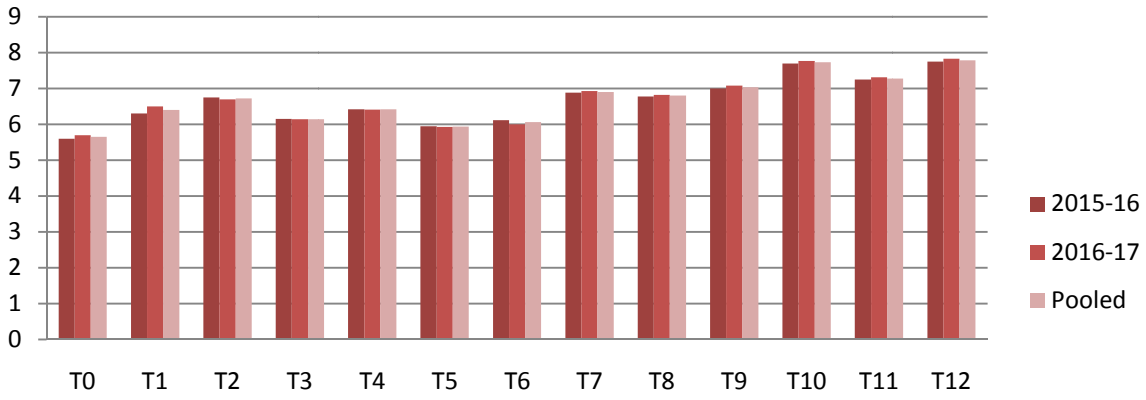

Fig. 4.176 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on texture at 3 day storage

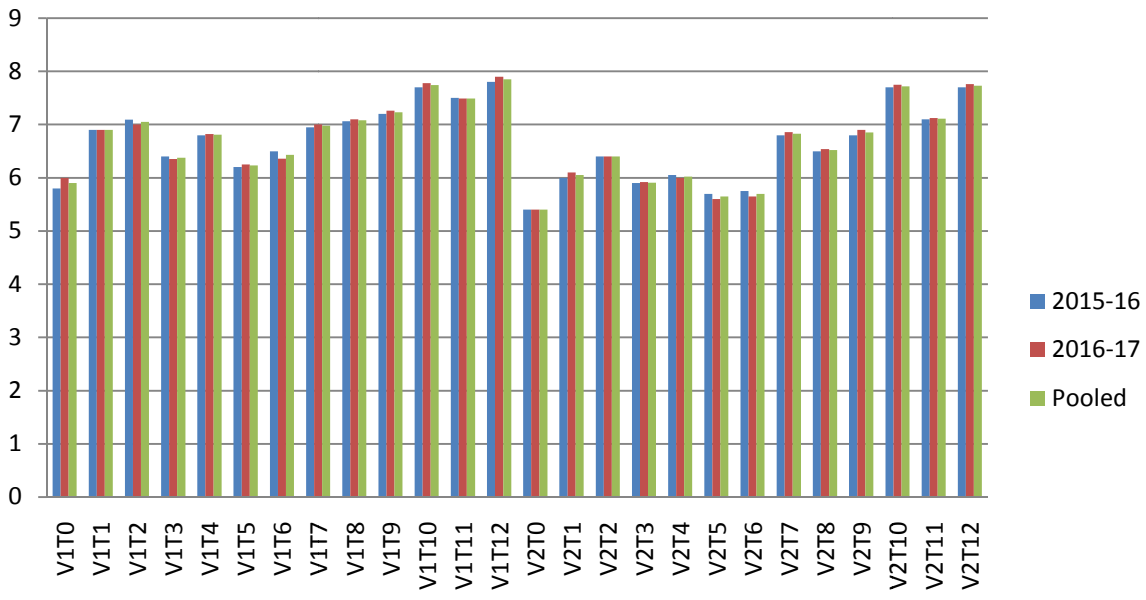

Fig. 4.177 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on texture at 3 day storage

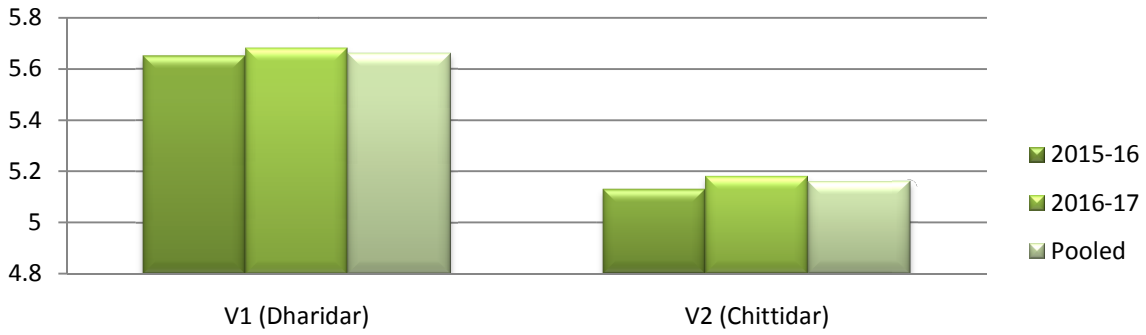

Fig. 4.178 Performance of varieties against texture at 6 day storage

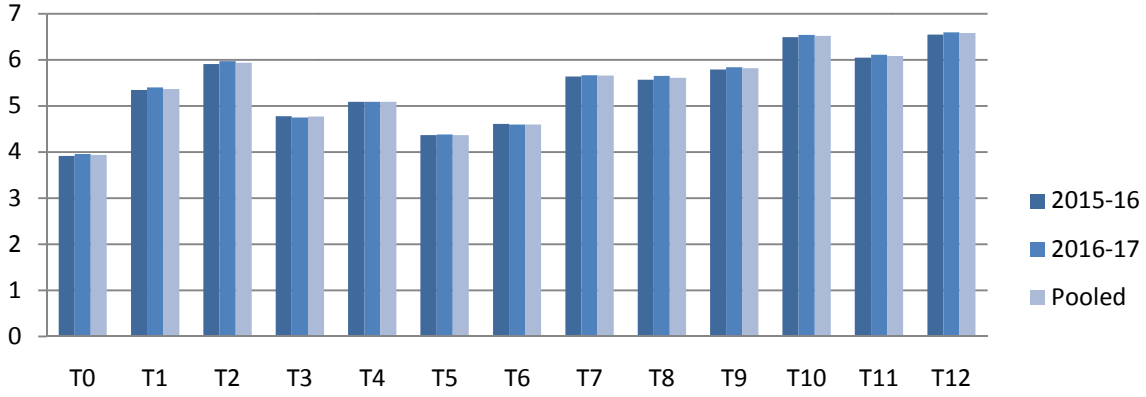

Fig. 4.179 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on texture at 6 day storage

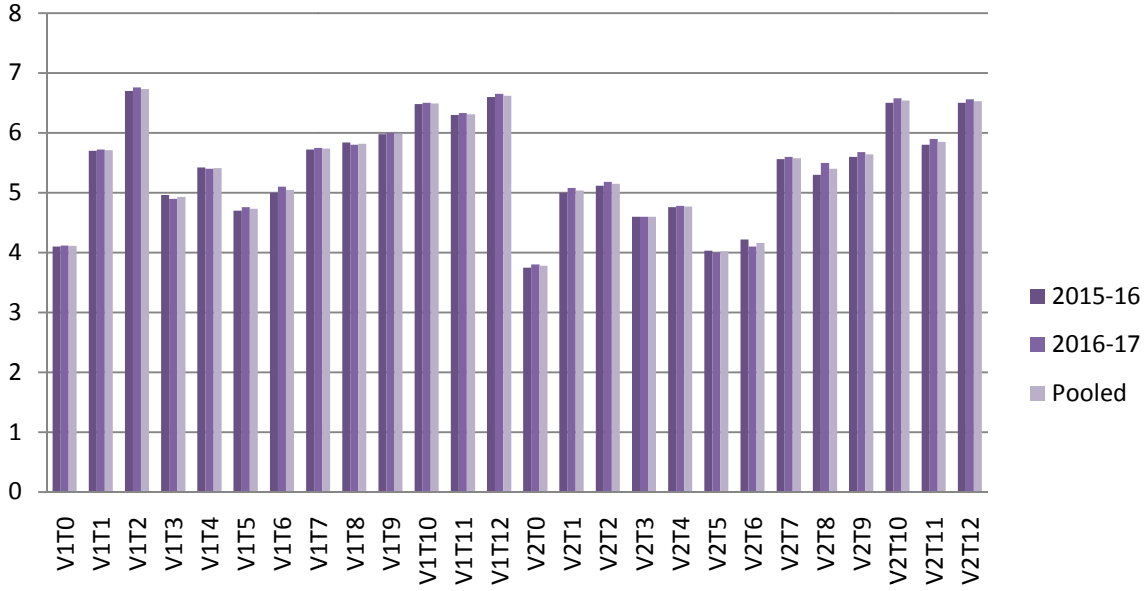

Fig. 4.180 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on texture at 6 day storage

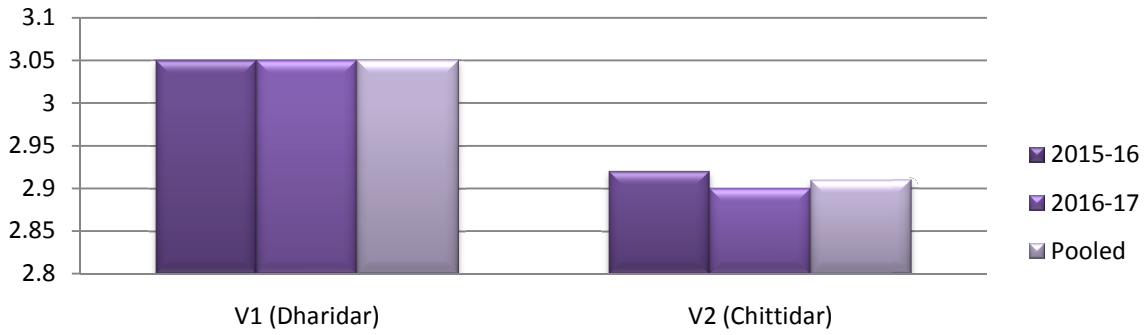

Fig. 4.181 Performance of varieties against texture at 9 day storage

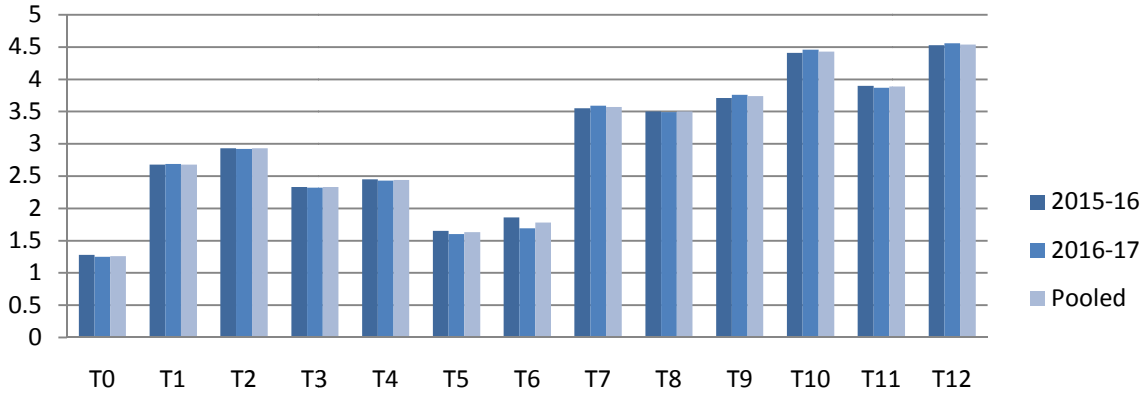

Fig. 4.182 Effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on texture at 9 day storage

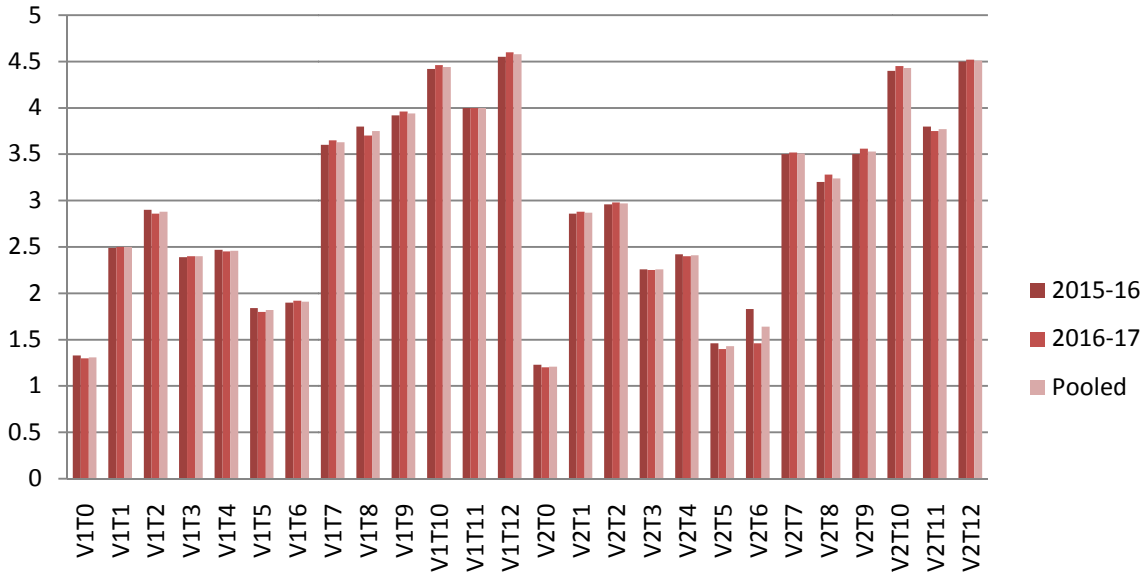

Fig. 4.183 Interaction effect of pre-harvest spray of GA_3, calcium nitrate and potassium sulphate on texture at 9 day storage

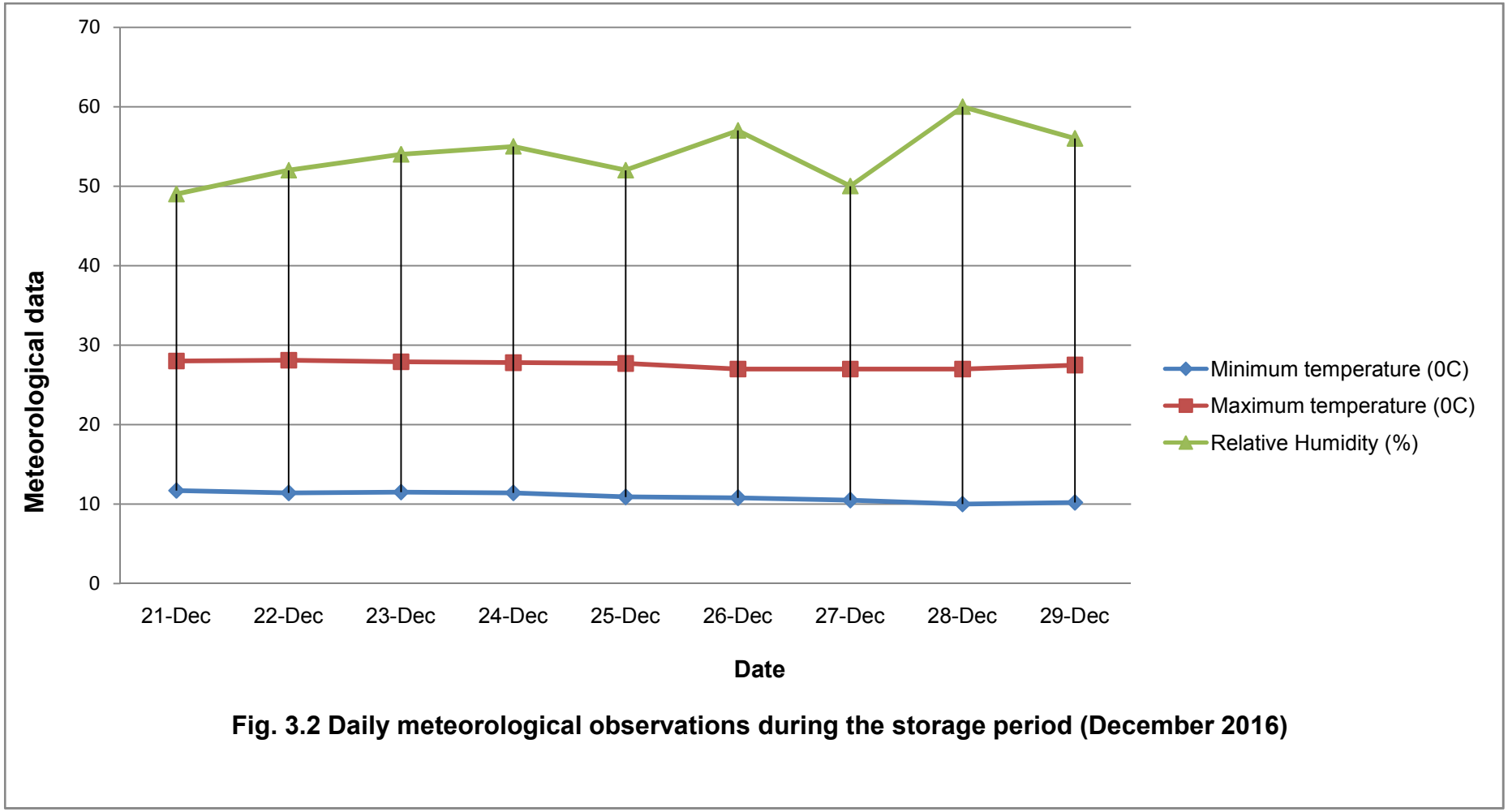

Fig. 3.2 Daily meteorological observations during the storage period (December 2016)

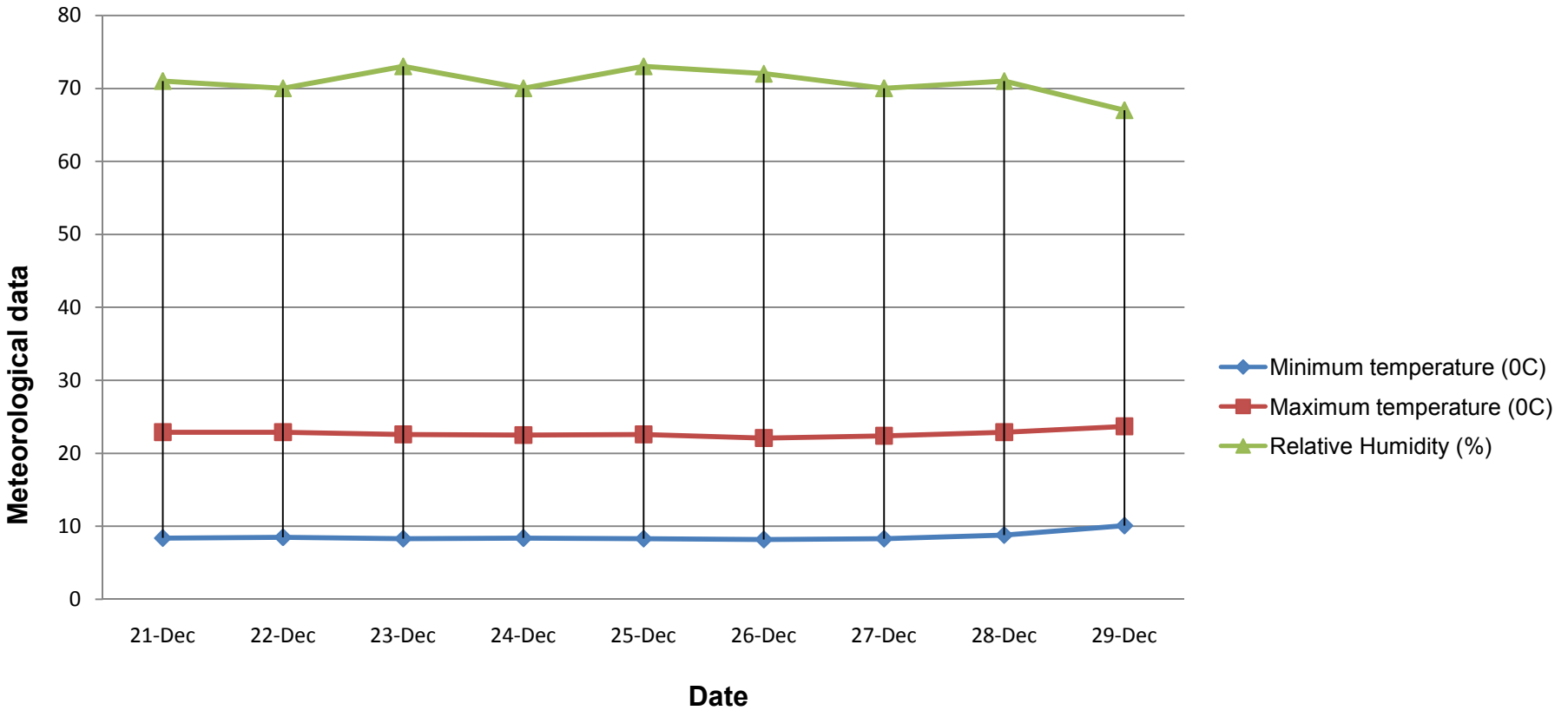

Fig. 3.1 Daily meteorological observations during the storage period (December 2015)

Plate 1 : 0 Day of Storage (2015-16)

Plate 2 : 0 Day of Storage (2016-17)

Plate 3 : 3 Days of Storage (2015-16)

Plate 4 : 3 Days of Storage (2016-17)

Plate 5 : 6 Days of Storage (2015-16)

Plate 6 : 6 Days of Storage (2016-17)

Plate 7 : 9 Days of Storage (2015-16)

Plate 8 : 9 Days of Storage (2016-17)