Prediction of storage potential and firmness loss of ‘Hayward’ kiwifruit along the supply chains in India

A thesis submitted in partial fulfilment of the requirements for the degree of

Master of Food Technology

Massey University,

Albany Campus, New Zealand

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February, 2012

ABSTRACT

Introduction: The ‘Hayward’ kiwifruit (*Actinidia deliciosa* (A. Chev.) C.F. Liang and A.R. Ferguson) is one the most common commercial variety grown in New Zealand. The long shelf-life of the ‘Hayward’ kiwifruit along with its inherent properties such as flavour, colour, texture and high content of vitamin C has allowed the development of New Zealand kiwifruit exports. However, the quality of the fruit can be affected by factors such as storage time and temperature along the supply chains to different markets. Temperature is one the major environmental factors influencing the quality and flesh firmness of the ‘Hayward’ kiwifruit. The softening of kiwifruit can be affected by increase in the environmental temperatures, leading to the deterioration of fruit quality. The aim of this study was to investigate changes in physiochemical parameters of kiwifruit along the supply chains to Indian markets, as well as development of predictive mathematical models for the loss of flesh firmness and storage potential of ‘Hayward’ kiwifruit along these supply chains.

Materials and Methods: The ‘Hayward’ kiwifruit grown in the regions of Bay of Plenty, New Zealand, were selected for this study. Three supply chains were identified through three local kiwifruit distributors based in India. Eighteen kiwifruit trays (six trays, each from three different grower lines) were selected for analysis along each supply chain. At each analysis point along the three supply chains, the ‘On arrival’ and ‘At departure’ quality of twenty fruits were analysed for flesh firmness (kgf), soluble solids content (%Brix) and core temperatures (°C). The flesh firmness of the fruit was measured using a penetrometer and the soluble solids content was measured using a refractometer. The core temperature of the fruit was determined using a core thermometer. The environmental temperature during storage and transportation along the supply chains were recorded using data loggers. Three fruit firmness loss models: Simple Exponential, Boltzmann and Inverse Exponential Polynomial were used to characterise the flesh firmness data collected along each supply chain. The Akaike Information Criteria (AIC) test was used to determine the most suitable model that characterised the flesh firmness loss along these supply chains. Three storage potential models: Reciprocal, Power and Reciprocal Quadratic, were fitted to the flesh firmness and core temperature data collected along each supply chain. The best model to predict the storage potential of kiwifruit was also determined by the AIC test.

Results: The flesh firmness decreased significantly ($P<0.05$) in all the grower lines along the three supply chains. The flesh firmness of kiwifruit decreased to the average level of commercial acceptability (1 kgf) within six to eight days of storage and transportation and further reductions were observed along the supply chains. The soluble solids content increased significantly ($P<0.05$) in kiwifruit belonging to the different grower lines with the variation in storage and transportation temperatures along the three supply chains. The Simple Exponential model best characterised the firmness data collected along Supply Chains 1 and 3, and the Boltzmann model was the second best model that characterised the firmness loss followed by the Inverse Exponential Polynomial model. Changes in the flesh firmness of the fruit along Supply Chain 2 were best characterised by the Boltzmann model followed by the Inverse Exponential Polynomial and Simple Exponential models. Among the three storage potential models, the Reciprocal model best fitted the data on flesh firmness and core temperature, collected in this study. The Power model was the second best storage potential model that characterised the data collected along the three supply chains. The Reciprocal Quadratic model was the least suitable model that characterised the flesh firmness and core temperature data in this study.

Conclusion: The flesh firmness and the soluble solids content of 'Hayward' kiwifruit were affected by temperature variations during storage and transportation along the three supply chains in India. The Simple Exponential model best characterised the flesh firmness data collected along Supply Chains 1 and 3 while the Boltzmann model best characterised the firmness data along Supply Chain 2. The Reciprocal model was the best model to characterise the flesh firmness and core temperature data in this study. The developed storage potential models can be used to determine the shelf-life of kiwifruit along similar supply chains to other markets.

ACKNOWLEDGEMENTS

The completion of my postgraduate studies in Food Technology at Massey University would have been impossible without the support and the help of several individuals and organizations.

First and foremost, I wish to acknowledge the financial support given by Zespri International Limited and the Ministry of Science and Technology (MSI) to conduct this project.

I am highly indebted to Dr Frank Bollen, In-Transit Fruit Conditioning Manager at Zespri International Limited, for his guidance and constant inspiration as well as for providing necessary information regarding the project. I would like to thank Alistair Mowat and Dr Greg Clark for creating an opportunity for me to work in this project. My deepest appreciation goes to Ian Stevens and his colleagues at AgFirst for training me during this study. I would also like to thank Ritesh Bhimani for his help during my stay in India.

I offer my sincerest gratitude to my supervisor, Dr. Tony Mutukumira, for his supervision, advice and guidance from the very early stage of this research. His crucial contribution and supervision has made him a backbone to this research and so to this report. Above all and most needed he provided me unflinching encouragement and support in various ways without which the completion of this project would not have been possible.

I gratefully acknowledge my co-supervisor, Alan Win, for his supervision and encouragement which helped me to complete this project. I would also like to thank him for sharing his views and ideas in moulding the project. I would like to thank Dr Daniel Walsh for helping me with the statistical analysis.

Words fail me to express my appreciation to my family whose love and persistent confidence in me have got me where I am today. I am grateful for their continuous support and help in achieving my goals and fulfilling my dreams. I would like to thank Sadia Seemeen, my best friend for her support during the research. I am extraordinarily fortunate in having Sandeep Patil as my partner. His love, support and encouragement has made this project a great success.

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ABBREVIATIONS

AIC	=	Akaike Information Criteria
ACC	=	1 aminocyclopropane-1-carboxylic acid
ANOVA	=	Analysis Of Variance
ATO	=	Agricultural Trade Office
CA	=	Controlled atmosphere
CSIRO	=	Commonwealth Scientific and Industrial Research Organisation
CT	=	Core temperature
DD	=	Degree-days
FEFO	=	First expire, first out
FF	=	Flesh firmness
FIFO	=	First in, first out
GAP	=	Good Agricultural Practice
HDPE	=	High Density Polyethylene
IEP	=	Inverse Exponential Polynomial
MA	=	Modified atmosphere
NTC	=	Negative temperature coefficient
PET	=	Polyethyleneteraphthalate
R&D	=	Research and Development
RH	=	Relative humidity
SAM	=	s-adenosylmethionine
SE	=	Simple Exponential
SEM	=	Scanning electron microscope
SSC	=	Soluble solids content
TA	=	Titratable acidity
WTC	=	White core inclusions

1.0 INTRODUCTION

Production of fruits worldwide has been increasing over many years, partly in response to a rising world population but also due to rising living standards in most countries. The international trade of fruits has been increasing rapidly every year to meet the demands of the growing population. The demand for fresh exotic tropical and subtropical fruits has also been rising due to the popularity of the taste and flavour of the fruits, the awareness of health benefits and their high nutritive values (Mitra, 2008). Kiwifruit is one of the subtropical fruits whose productivity in New Zealand has increased steadily over the past ten years. There has been a high demand and potential market for this fruit in the northern hemisphere (Richards, 1990). Kiwifruit exports benefit from favourable exchange rates, production and high fruit quality. Zespri International Limited is the world's largest marketer of kiwifruit, exporting kiwifruit to more than 60 countries around the world and the company aims to export superior quality kiwifruits to India and expand the export market in Asia (Shah, 2009).

Kiwifruit, a subtropical fruit is perishable and delicate whose quality is affected by the temperature and relative humidity of its surroundings. The fruit is highly sensitive to low concentrations of ethylene. Environmental factors such as temperature, relative humidity and atmospheric composition influence the maturation of the fruit. The biological factors involved in the deterioration of the fruit include respiration, ethylene production, compositional changes and transpiration (Kader et al., 1985). After harvest, the fruit still respires and the process of respiration continues during storage and handling thereby leading to undesired changes in quality attributes. Storage of the fruit is very important for its quality, in particular for its organoleptic flavour properties. Hence, by understanding the factors leading to the loss of the quality or the generation of unsalable material, affordable technologies are developed to minimize the rate of deterioration (Wills, McGlasson, Graham, & Joyce, 1998).

Maturation at the time of harvest is one of the important factors that affect the quality of the fruit along the supply chain (Gortner, Dull, & Krauss, 1967). At the stage of maturation, kiwifruits exhibit little changes in appearance and density. They reach nearly full size well in advance of maturity. Several physical and chemical characteristics such as surface colour, flesh colour, soluble solids content (SSC), titratable acidity (TA), SSC:TA, starch disappearance, seed colour change and flesh firmness change as the fruit approaches maturity (Kader, 2002). The acid composition changes slightly during the development but the titratable acidity changes only after a period of storage. Starch disappearance is not easily measurable until ripening begins. Therefore, soluble solids content taken at the harvest time has been the most widely used maturity index to predict a minimum quality and storage performance (Given, 1993).

Appropriate technological conditions like harvesting methods, time-temperature conditions and packaging concepts, uniform control along the supply chain and consistent food handling positively contributes to the maintenance of desired quality attributes (Sommer, Fortlage, & Edward, 1983). Processing of the fruit like rapid cooling after harvest also helps to maintain the quality of the fruit. Efficient temperature management is essential to successful marketing of kiwifruit. Cooling of the fruit to remove the field heat after harvesting is very important as the fruit can lose water rapidly (Hasey, 1994). After 3 to 4 percent of water loss, the fruit exhibits noticeable shrivelling, predominantly at the stem end. The rate of water loss is directly proportional to vapour pressure gradient between the fruit and its environmental. Another reason for rapid cooling of the fruit after harvest is based on the kiwifruit's propensity to rapidly soften after harvest. The softening process of kiwifruit is temperature dependent (Hasey, 1994).

1.1 Main Objective

The main objective of this study was to monitor the change in the physicochemical parameters kiwifruit along the identified cool (supply) chains in India and develop mathematical models to predict quality change along the supply chains.

1.2 Specific Objectives

1. To identify three supply chains through the Indian kiwifruit importers/distributors;
2. To measure the change in the physiological parameters including flesh firmness, core temperature and soluble solids content (SSC) of ‘Hayward’ kiwifruit from three different grower lines along the identified supply chains; and
3. To develop predictive mathematical models for the storage potential and firmness loss of ‘Hayward’ kiwifruit along the Indian supply chains.

2.0 LITERATURE REVIEW

2.1 Introduction

The demand for tropical and subtropical fruits has been steadily increasing worldwide. In the last three decades, production of tropical and subtropical fruits has markedly increased in most Asian countries, Australia, New Zealand and South Africa where they make a significant contribution towards export earnings. However, tropical and subtropical fruits are associated with specific problems in conservation and transportation because they are much more perishable than the temperate tree fruits. This is further compounded by long distances between the producing countries and the major export markets. Depending on the type of market, it is estimated that 10-60% of the harvested fruits are lost due to poor postharvest handling. As consumer demand is based on quality of the fruit, it becomes essential to maintain quality and minimize postharvest losses. Hence this requires more Research & Development (R&D) in the application of technology to evaluate and enhance quality, especially in the handling and storage of horticultural produce (Mitra, 2008).

The quality of the fruit at harvest can have a major effect on its postharvest life. There are numerous factors involved and these factors frequently interact, giving complex interrelationships (Thompson., 2003b). Postharvest losses including qualitative and quantitative occur in horticultural products between harvest and consumption. The actual causes of postharvest loss are many but can be classified into two main categories. The first of these is physical loss, which can arise from structural damage or microbial wastage, which can leave produce tissue degraded to a stage where it is not acceptable for presentation, fresh consumption or processing. Physical loss can also arise from the evaporation of intercellular water, which leads to a direct loss in weight (Wills et al., 1998).

Loss of quality is the second cause of postharvest loss, and this can be due to physiological and compositional changes that alter the appearance, taste or texture and make produce less desirable aesthetically to consumers (Kader & Rolle, 2004). The changes may be because of the normal metabolism of produce or abnormal events arising from the postharvest environmental. Economic loss is incurred in having to market such produce at a reduced price. In many markets there is no demand for second class produce even at a reduced price, thereby leading to a total economic loss even though it may still be edible (Wills et al., 1998).

Qualitative losses, such as loss in edibility, nutritional quality, caloric value and consumer acceptability of fruits, are much more difficult to assess compared to quantitative losses (Rolle, 2006a). Quality standards, consumer preferences, and purchasing power vary greatly across countries and cultures, and these differences influence the marketability and the magnitude of postharvest losses. The magnitude of postharvest losses in horticultural products is estimated to be 5-25% in developed countries and 20-50% in developing countries with about one third of horticultural products being wasted (Rolle, 2006b).

In order to maintain the quality of the fruit during storage and transportation, various postharvest technologies have been implemented (Kader & Rolle, 2004). Different storage methods are used for the conservation of the fruit such as air storage, controlled freezing-point storage at 0°C, modified atmospheric packaging storage, controlled atmosphere storage and ozone-enriched atmosphere storage (Antunes & Sfakiotakis, 2002). During ripening, the fruit undergoes biochemical changes including conversion of starch to sugar, changes in cell wall constituents and production of characteristic volatiles which lead to the taste, texture and aroma desired by consumers (Ritenour, Crisosto, Garner, Cheng, & Zoffoli, 1999).

Kiwifruit, a climacteric fruit that can ripen on or off vine, is extremely sensitive to ethylene action, even at concentrations as low as 20 parts per billion (ppb) and even at low temperatures such as 0°C (32°F). The composition of the fruit changes from the time of development till the ripening of the fruit. In the kiwifruit, the carbohydrates are mostly accumulated in the form of starch during the development. At the time of harvesting when maturity level is reached, most of the carbohydrates are hydrolyzed to simple sugars (Asfhar-Mohammadian, 2010). The simple sugars which accumulate during maturation and ripening include sucrose, glucose and fructose. The soluble solid content is as low as 2% during development and increases at maturation. Optimum levels of SSC are 6.5% at maturity and increases up to 14% during ripening (Crisosto & Kader, 1999; Ferguson, 1990b; Park, Jung, & Gorinstein, 2006). Rapid flesh softening during the first 6 to 8 weeks of storage is paralleled by, and may be related to the starch hydrolysis (Hasey, Johnson, Grant, & Reil, 1994). The flesh firmness is lost during the ripening process as the pectin content decreases in the cell walls of pericarp tissues. Several changes in the physiochemical parameters of the fruit indicate the stages of the growth, development, maturity and ripening (Asfhar-Mohammadian, 2010).

Recommendations of storage conditions to maintain the quality of perishable horticultural commodities can vary considerably even for the same species. It is impossible to be absolutely definite about storage conditions because even though there is a recommendation that a crop should be stored at a certain temperature, humidity and even gaseous environmental and under those conditions they will have certain storage life, this can be affected by many other factors. Factors such as the condition in which the crop was grown, the harvest maturity, the crop cultivar, pre-cooling and contamination by microorganisms affect the storage life of the crop (Thompson., 2003b).

2.2 Kiwifruit

Kiwifruit belongs to the genus *Actinidia*, which is solely of Asian origin (Ferguson, 1990a). The kiwifruit vines are found ranging from North East India through China into cold climates of Manchuria, Japan and eastern Siberia. It was introduced to New Zealand, Europe and United States of America (USA) at the turn of the 19th century. Commercial production of kiwifruit in New Zealand began in the 1930's and the first kiwifruit export started in 1960 (Abedini, 2004). The main commercial producers are Italy, New Zealand, Chile, France, Japan, USA, Iran, Greece, Spain and Portugal (Abedini, 2004). Cultivation of this fruit is also found in the north eastern regions of India. However, the total productivity is low and fails to suffice the high market demand (Chandel & Rana, 2002) and hence the need to import the fruit into India from the largest kiwifruit producing countries.

The two commercially important *Actinidia* species are *Actinidia deliciosa* and *Actinidia chinensis* (Liang & Ferguson, 1984, 1986). The most common commercial varieties of kiwifruit cultivated in New Zealand are Hayward, Bruno and Allison and these varieties belong to the species *Actinidia deliciosa*. Commercial plantings of kiwifruit around the world now amount to about 150,000 ha and total annual production to about 1.8 million tons (Belrose Inc, 2010). Outside China, the *A. deliciosa* cultivar 'Hayward' and its associated males still predominate. 'Hayward' is traditional "Green" kiwifruit well known to consumers for its bright green fruit flesh (Belrose Inc, 2010). It is the most common commercial variety world-wide, especially in New Zealand, Italy and Chile (Cheng et al., 2004) and 'Hayward' is the only cultivar planted along with its corresponding males (All *Actinidia* species are dioecious, with both male and female vines required for fruit production).

'Hayward' has become the standard cultivar of international commerce in kiwifruit accounting for more than 95% of the kiwifruit traded. 'Hayward' is grown and exported in many countries including New Zealand, Italy and Chile, because of its distinctive features like high yield, large fruit size, better appearance and the flavour (Nishiyama, Yamashita et al., 2004). Most important of all is the long storage life of 'Hayward' variety, which allows the development of kiwifruit industry based on exports by ship to distant markets. Six kiwifruit cultivars grown in the same orchard in the Bay of Plenty, New Zealand, were compared with 'Hayward' in terms of fruit maturation, postharvest behaviour and sensory quality. 'Hayward' and Wilkins Super (a bud sport of 'Hayward') were the slowest to soften in cold storage. Sensory characteristics of 'Hayward' fruit were as acceptable or more acceptable overall than those of the other cultivars. Results confirm the choice of 'Hayward' as the most commercially viable kiwifruit cultivar in terms of storage life and sensory quality (Cotter & MacRae, 1991).

The success of the kiwifruit is basically attributable to the inherent qualities of the fruit, to this ease of handling and to its appeal to the consumers - an appeal due to its beautiful green flesh, flavour, texture and high content of vitamin C (Ferguson, 1999). Newer cultivars of "Green" kiwifruit well known, usually seedlings of 'Hayward' are now emerging, particularly in Italy although none is yet widely grown (Testolin & Ferguson, 2009). "Gold" kiwifruit, which are yellow-fleshed cultivars of *Actinidia chinensis* are becoming increasingly important. In New Zealand "Gold' kiwifruit from the cultivar 'Hort16A' account for around 30% of the total production of kiwifruit. Cultivars of *A. chinensis* have relatively short storage lives compared to the *A. deliciosa*. 'Hort16A' or Gold kiwifruit is one among the better cultivars of *A. chinensis* with an expected storage life of 12-16 weeks (Ferguson & Huang, 2007).

Botanically, kiwifruit is a berry with numerous locules filled with many small, soft, black seeds. The green coloured flesh (edible portion) has three regions: the outer pericarp, the inner pericarp and the columella (core), which is lighter green than the pericarp tissues (Figure 2.1). The relatively thin brown skin includes a periderm and hypodermal cells (Ferguson, 1984; Hasey et al., 1994). No stomata are observed on the kiwifruit surface, but other openings where trichomes are removed provide adequate gas exchange. Kiwifruit have large and small hairs (trichomes) on the surface. Small hairs may be an arrested early stage of development of large hairs, which are multi-celled and sometimes branched (Beever & Hopkirk, 1990). Most of the small unicellular hairs on the surface of mature kiwifruit are collapsed as a result of handling during harvesting and postharvest operations (Beever & Hopkirk, 1990; Hasey et al., 1994).

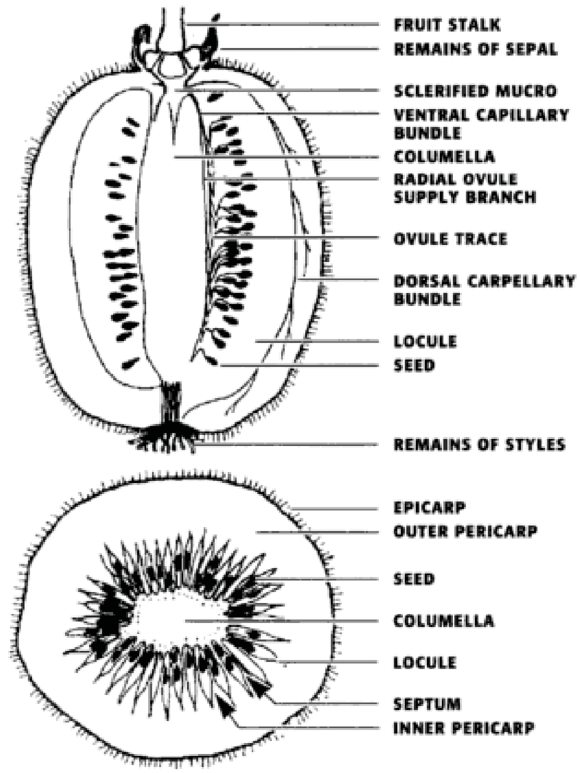


Figure 2.1 Top: Longitudinal midsection of mature 'Hayward' kiwifruit. Bottom: Cross midsection of kiwifruit (Source: Ferguson, 1984).

2.3 Chemical composition of Green kiwifruit

Fruit play a significant role in human nutrition, especially as source of vitamins, minerals, dietary fiber and antioxidants. Increased consumption of variety of fruits on daily basis is highly recommended because of the associated health benefits which include reduced risk of some forms of cancer, heart disease, stroke and other chronic diseases (Apple, Moore, & Obarzanek, 2006; Giovannucci, Liu, Platz, Stampfer, & Willet, 2007; He, Nowson, Lucas, & MacGregor, 2007; Hung, Joshipura, & Jiang, 2004). Kiwifruit is considered as one of the best fruits due to its high nutritive value (Ferguson & Stanley, 2003). Besides a rich source of vitamin C, kiwifruit contains a fair amount of minerals (calcium, magnesium, nitrogen, phosphorous, potassium, iron, sodium, manganese, zinc and copper) and vitamins (A, B_1, B_2, B_6 and E) (Samadi-Maybodi & Shariat, 2003). Kiwifruit contain 90-95% edible portion, with 80-85% moisture, 1.0-1.6% acid, 0.7-0.9% oil, 0.11-1.2% protein, 0.45-0.74% ash1.1-

1.3% fiber, 17.5% carbohydrate and 12-18% total soluble solids (Abedini, 2004; Mohammadian & Teimouri, 1999).

Proteins, lipids and amino acids

Kiwifruit like most other fruits, contain insignificant amounts of proteins, lipids and amino acids (Table 2.1) (Ferguson & Stanley, 2003).

Carbohydrates

Ripe kiwifruit contain almost no starch as it has largely been converted during ripening into soluble sugars, mainly glucose, smaller quantities of fructose and minor amounts of sucrose (Table 2.1). Carbohydrates in kiwifruit would normally meet only a very small part of the daily requirements (Barboni, Cannac, & Chiaramonti, 2006; Beever & Hopkirk, 1990).

Minerals

Kiwifruit are typical fruits, being a good source of potassium, with a high potassium-to-sodium ratio. They are also a useful source of magnesium, with about 25 mg per 100g (Table 2.1). Other minerals that are present in insignificant quantities in kiwifruit include calcium, phosphorous, iron and manganese (Samadi-Maybodi & Shariat, 2003).

Vitamin C

Vitamin C is currently recognized as the single most important nutrient in kiwifruit. ‘Hayward’ kiwifruit typically contains about 80 mg ascorbate per 100g fresh weight of edible portion (Ferguson & Stanley, 2003; Rassam & Liang, 2005). The vitamin C content can vary with fruit size, position on the vine, the season and growing location. Many kiwifruits are eaten after having remained in cool store for long periods and it is therefore a great advantage that comparatively little vitamin C is lost from kiwifruit during storage or ripening. A 'Hayward' kiwifruit stored for 6 months at 0°C and then ripened will still contain at least 90% of vitamin C present in the fruit at harvest and hence show little or no loss of vitamin C during storage over extended periods. It is therefore very likely that when consumers buy or actually eat kiwifruit fruit, the fruit contain about as much vitamin C as they did at harvest (Tavarini, Degl'Innocenti, Remorini, Massai, & Guidi, 2008). Assuming usual storage conditions and sensible handling, kiwifruit that are acceptable eating are also likely to be an excellent source of vitamin C. Kiwifruit contain more vitamin C than almost all other fruits: on a fresh weight basis, they typically contain 50% more vitamin C than an orange, five or six times as much as a banana and ten times as blackcurrants, are richer in vitamin C (ascorbate) (Lee & Kader, 2000).

Other vitamins

One kiwifruit could provide 10-20% of the daily requirements for folic acid. Other vitamins present in kiwifruit include vitamins A, $B_{1,}$ B_3 and B_6. Vitamin E in kiwifruit is present in the seed, which might be unavailable as these seeds survive passage through the gut (Ferguson & Stanley, 2003).

Pigments

'Hayward' kiwifruit (green-fleshed fruit) are amongst the very few that are still green when ripe. This colour is due to the presence of chlorophyll and although many other common fruits are green during the early stages of development, they lose their chlorophyll during subsequent maturation and ripening. The colour of green kiwifruit is one of their most appealing characteristics (Ferguson & Stanley, 2003).

Oxalate

Kiwifruit contain appreciable but not exceptional amounts of oxalate (Rassam & Liang, 2005). At least half of the oxalate present in the fruit is complexed as highly insoluble calcium oxalate, mostly in the form of rapides (needle like crystals), which could render much of the calcium in the fruit unavailable. The levels of oxalate in kiwifruit do not constitute a nutritional problem, assuming normal consumption, as other common foods, e.g. spinach, contain much higher levels (Ferguson & Stanley, 2003). Eating processed 'Hayward' kiwifruit products such as nectars, dried slices, or fruit leathers can cause irritation of the mucous membranes of the mouth. This is due to the mechanical irritation of the membranes by the oxalate raphides. In the fresh fruit, the raphides are embedded in the mucilage and therefore do not cause any appreciable irritation. The shape of the raphides varies with *Actinidia* species and this can affect the amount of irritation caused (Ferguson & Stanley, 2003).

Actinidin

Kiwifruit contain large amounts of the highly active proteolytic enzyme actinidin similar to the proteases found in other fruits such as pineapples, figs or papaya (Nishiyama, Fukuda, & Oota, 2004). Actinidin is ideal as a meat tenderizer but can cause problems if fresh fruit are incorporated into gelatin based jellies or are mixed with dairy products. Actinidin, at levels found in 'Hayward' kiwifruit does not seem to be a major health hazard for most people, but has been associated with allergy to the lips (especially at the corners of the mouth) but only if very large quantities of fruit are eaten (Ferguson & Stanley, 2003; Nishiyama, Fukuda et al., 2004). Peeling large number of fresh fruit can result in skin damage if hands are not protected.

Dietary fiber

Kiwifruit contain about 2-3% dietary fiber due to pectins and other oligosaccharides and polysaccharides that are not broken down and absorbed in the small intestine. A 100g serving of kiwifruit will therefore supply about 10% of the recommended daily requirement. The relative contributions of the various polysaccharide fractions in kiwifruit to dietary fiber effects such as stool-bulking and laxative action are undefined (Ferguson & Stanley, 2003).

Table 2.1: Chemical composition of 'Hayward' (*Actinidia deliciosa*) kiwifruit

Proximates	g100 g^{-1} fresh weight edible portion
Total solids	15–20
Protein	0.5
Lipids	1
Carbohydrate	15
Calcium	0.04
Chloride	0.35
Iron	0.004
Magnesium	0.25
Phosphorus	0.03
Potassium	3
Sodium	0.05
Vitamin C	0.8-1.0

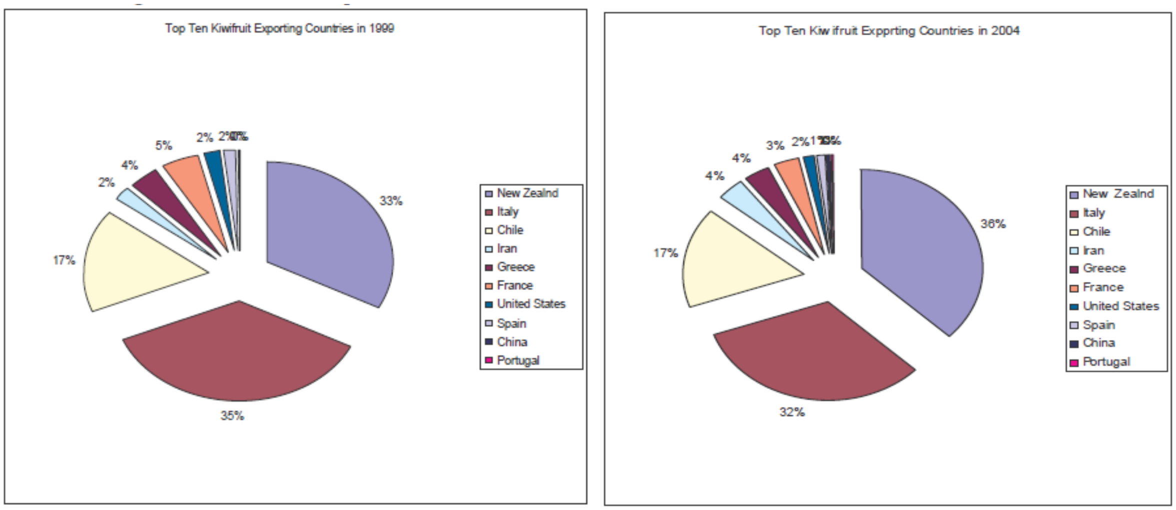
(Source: Ferguson and Stanley, 2003)

2.4 World production and export of kiwifruit

The principal areas of kiwifruit production are located approximately between the latitudes 25° and 45°. Kiwifruit are deciduous, temperate plants and require a period of chilling temperature for adequate bud break and flowering. They are susceptible to damage from spring and autumn frosts and, depending on the species and cultivar, require a long frost-free growing period of at least seven or eight months (about 220 days). The fruit also requires shelter from strong winds and have a high demand for water. Irrigation must be sufficient to supplement natural rainfall to between 800 and 1200 mm of water throughout the growing season (Kilgour, Saunders, Scrimgeour, & Zellman, 2007).

There are extensive natural resources of kiwifruit in China and appreciable quantities of fruit are collected from the wild each year. China also has the greatest commercial orchards of kiwifruit, about 50,000 ha. Outside China, there are about 70,000 ha planted with kiwifruit, approximately 20,000 ha in Italy, 12,000 ha in New Zealand and 8,000 ha in Chile. Many of these plantings, particularly in China, are still not mature and therefore yields are still increasing. Production in the various countries also varies with the climatic conditions each year (Kilgour et al., 2007).

In 2001, Italy produced around 350,000 tonnes of kiwifruit, New Zealand 250,000 tonnes, and China and Chile each about 150,000 tonnes (Huang & Ferguson, 2001). The kiwifruit industries of New Zealand, Chile and Italy are dependent on exports and these industries expanded largely to meet external demand (Ferguson & Stanley, 2003). Thus, 85-90% of the kiwifruit produced in New Zealand are exported, and Chile and Italy each export about 75% of the fruit they produce. China is quite different and nearly all the kiwifruit produced is consumed domestically and exports are negligible. The top ten countries exporting kiwifruit include New Zealand, Italy, Chile, Iran, Greece, France, United States, Spain, China and Portugal (Figure 2.2) (Kilgour et al., 2007).



(a) (b)

Figure 2.2: Top ten kiwifruit exporting countries in year 1999 (a) and 2004 (b) (Source: Kilgour et al., 2007).

In New Zealand, export volumes of kiwifruit and earnings have continued to increase (Figure 2.3), although production eased in the late 1980's as the industry experienced falling prices for kiwifruit. Kiwifruit exports in 1975 earned NZ$ 2.9 million and three decades later in 2005, they were at NZ$ 680.9 million. In 2006, kiwifruit industry contributed to around 2.5 percent of New Zealand's merchandise trade and over 60 percent of total fruit export (Kilgour et al., 2007).

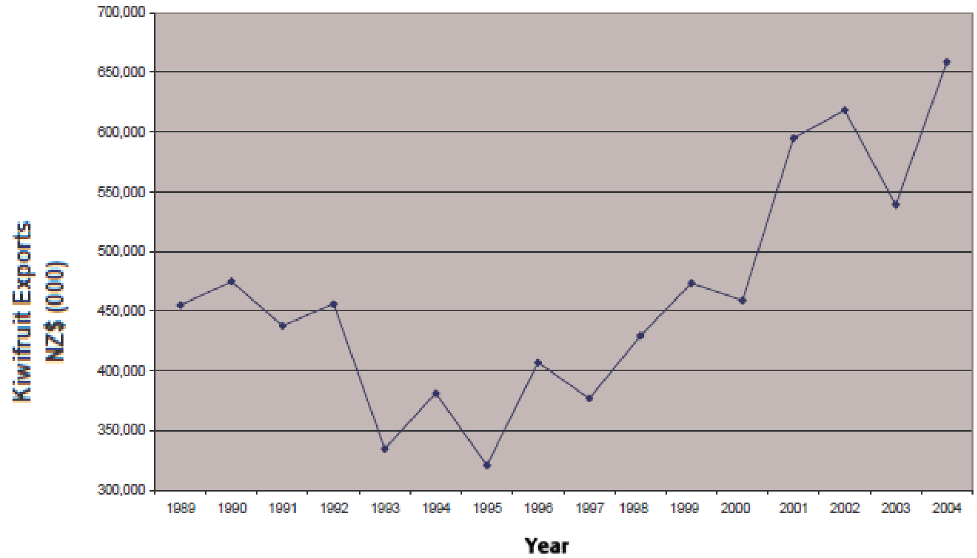


Figure 2.3: Kiwifruit export earnings by New Zealand kiwifruit industry from 1989 to 2004 (Source: Kilgour et al., 2007).

Kiwifruit exports earned about NZ$785 million in 2006, making up over 30% of New Zealand's total horticultural export earnings. This value cones from the production of 84.7 million trays supplied by Zespri International Ltd (Statistics New Zealand, 2006). As New Zealand (via Zespri International Ltd) seeks to sell its products at a substantial premium price over its competitors to the major markets for New Zealand kiwifruit which are high-income markets that can support such premium prices. Its major markets are in Europe (EU), Japan and United States. Within the EU market, growth has been the strongest in Spain. In Asia, the largest growth has been in sales to South Korea, Taiwan and Hong Kong. In 2004 and 2005 strong growth was also experienced in Japan (New Zealand's oldest Asian market) (World Kiwifruit Review, 2006). Zespri International Limited which is controlled by the New Zealand kiwifruit growers sold over 98.1 million trays of premium-quality kiwifruit to more than 50 countries in the year 2010-2011 (Zespri Annual Report, 2011). Zespri International Limited continues to expand the export market by providing high-quality fruits. The expansion of export has lead to the development of markets in countries like India and Singapore and these markets are in the process of establishment (Zespri Annual Report, 2011).

2.5 Biological factors influencing fruit deterioration

2.5.1 Harvest maturity

The stage of maturity at which any fruit is harvested influences both the ability of the fruit to be stored for long periods and its final eating quality (Perera, Young, & Beever, 1998). All fruits rely on the parental plant for their supplies of water and nutrients during growth, however, at a particular stage of development, the fruit may be removed from the plant and yet they will still continue to develop physiologically until it is suitable for consumption. This stage of development is referred to as physiological maturity. The subsequent development, either on or off plant that is usually required before a fruit is at its optimum condition for eating is called ripening. Further development leads to deterioration in eating quality, during the process of senescence (Beever & Hopkirk, 1990).

Changes in the chemical composition of the fruit as they mature on the vine are used to determine when the fruit is safe to be picked (Perera et al., 1998). Maturity values are taken on representative samples of fruit from vines of an individual maturity area, an area in which the vine are presumed to be similar through uniformity of age, management, and growing environmental. The harvest maturity for ‘Hayward’ kiwifruit is usually assessed using soluble solids content of the fruit as determined by a refractometer. As the fruit matures, soluble solids content increases, largely as a result of conversion of starch to sugars. In New Zealand, a minimum maturity index of 6.2 Brix is normally used following a standardised measurement procedure. In other countries a minimum maturity index of 6.5 Brix has been set (Ferguson & Stanley, 2003).

Mitchell et al. (1992) studied the effects of harvest maturity on storage performance of ‘Hayward’ kiwifruit. Fruit was harvested over a period of 40 days from 6 locations in North California in 1988 and 1989. Fruits were immediately cooled and stored in air with ethylene removed at 0°C and monitored at 0, 2, 4, and 6 months. Fruit harvested at 8.2 kgf (18 lbf) in late September, averaged to 0.6 kgf (1.3 lbf) at the end of 6 months while the fruit harvested in late November at about 6.8 kgf (15 lbf) averaged to 1.8 kgf (3.9 lbf) after 6 months storage. Storage tests show that late harvested kiwifruit retain their flesh firmness better than earlier harvested fruit. The flesh firmness improvement was progressive across the five harvest dates taken at 10 days interval. This pattern of improved flesh firmness retention with later harvest was consistent over both seasons in samples from 6 different locations (Figure 2.4). Thus, kiwifruit destined for long storage periods should benefit from delayed harvest (Mitchell, Mayer, & Biasi, 1992).

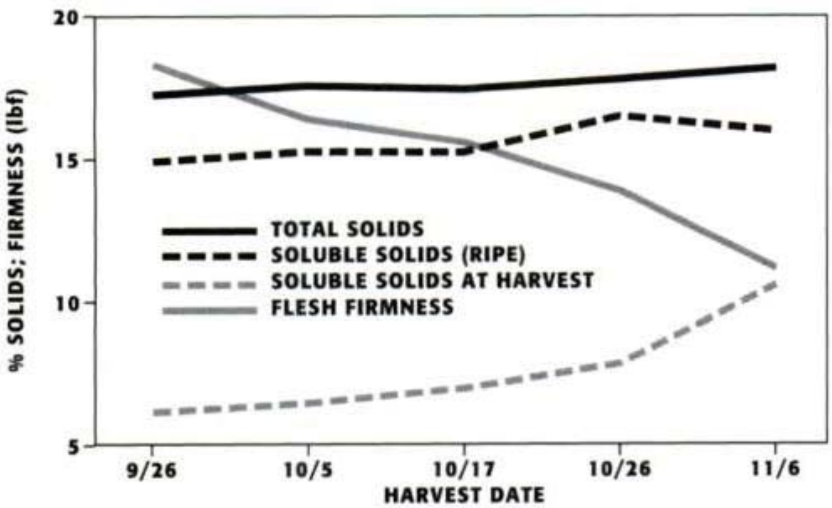


Figure 2.4: The pattern of changes in flesh firmness, soluble solids of fruit at harvest and after ripening and total solids of kiwifruit monitored at six California locations in 1988 and 1989 (Source: Mitchell et al. 1992).

2.5.2 Respiration

Respiration is an overall process which involves breakdown of stored organic materials (carbohydrates, proteins and fats) to simple end products with a release of energy. During respiration, loss of stored food reserves in the commodity is observed. This means, senescence is hastened as the reserves providing energy for the living status maintenance are exhausted. Loss of food value (energy value) to the consumer, reduced flavour quality, especially sweetness and loss of salable dry weight is observed (Kader et al., 1985).

The rate of deterioration (perishability) of harvest product is proportional to their respiration rate. Based on the respiration rate and ethylene production patterns during maturation and ripening, fruits can be classified as climacteric and non-climacteric fruits. Kiwifruit, belonging to the climacteric group exhibits a large increase in carbon dioxide (CO_2) and ethylene (C_2H_2) production rates coincident with their ripening, while non-climacteric fruits like orange and grapes exhibit no changes in their generally low CO_2 and C_2H_2 production rates during ripening (Thompson., 2003b).

Like all fresh fruits, kiwifruit also continues its life process and respiration until processed and consumed. The energy required for maintaining these life processes is generated through respiration, during the oxidation of stored food reserves. Respiration leads to conversion of starches to sugars, development of flavours and odours, flesh softening, acid content changes and ultimately ripening of the fruit (Given, 1993).

Respiration activity of kiwifruit is low, in the same range as that of apples and grapes because of which kiwifruit can be stored for a fairly long time. The typical respiratory activity start at 3 to 7 mg CO_2/kg-hr at 32°F (0°C) with temperature coefficient (Q_{10}) close to 3.0, which means that the rate of respiratory activity increases by three-fold for each 18°F (10°C) temperature rise. The estimated rate of respiratory activity (in ml CO_2/kg.hr) for kiwifruit could be about 1.5-2.0 at 0°C, 2.6-3.6 at 5°C, 4.7-6.3 at 10°C, 8.6-11.8 at 15°C, 14.7-19.6 at 20°C and 26.0-33.1 at 25°C. The rate of physiological processes including respiration, increases rapidly with ripening. The increased rates of respiration and ethylene production do not occur until the fruit is fully ripe (Hasey et al., 1994). Thus, by maintaining the kiwifruit in an unripe condition, the rate of respiration can be kept low.

A study conducted by Heyes et al. (2010), observed the respiration rates to be closely correlated to equilibrated temperatures. The fruits were equilibrated for 2-4 days at 1, 5, 10 and 20°C and the respiration rates were determined by measuring the CO_2 concentrations.

The respiration rates showed clear exponential rise across the temperature range (Heyes, Tanner, & East, 2010). The rates of respiration of green kiwifruit showed an initial rapid increase when the fruit were transferred into a new temperature storage, but by 48 hours after transfer, respiration rates had stabilized according to the storage temperature (Antunes & Sfakiotakis, 1997). Respiratory changes of four different cultivar varieties of kiwifruit were studied during storage at 0°C. The respiration rates were low for 'Hayward' cultivar compared to Allison, Bruno and Monty. The respiration rates ranged between 1.5-2.0 ml CO_2/kg-h at 0°C (Manolopoulou & Papadopoulou, 1998).

2.5.3 Ethylene production

Ethylene is an organic compound that has an effect on the physiological processes of plants and also a natural product of plant metabolism. Ethylene is considered the natural aging and ripening hormone and is physiologically active in trace amounts (less than 0.1 ppm). The change in physiology of climacteric fruit from maturation to ripening is initiated when cellular quantities of ethylene reach the threshold level (Hofman & Smith, 1993). The ripening process is accompanied by a respiration peak and a concomitant burst in ethylene production (Alexander & Grierson, 2002; Giovannoni, 2004; Lelievre, Latche, Jones, Bouzayen, & Pech, 1997). This ethylene burst results from the autocatalytic stimulation of ethylene synthesis. The metabolic pathway that results in ethylene production is complex, which involves a series of steps culminating in the synthesis of SAM (S-adenosylmethionine) that is converted to ACC (1-aminocyclopropane-1-carboxylic acid) by the action of ACC synthase. ACC acts as an immediate precursor of ethylene biosynthesis and ACC oxidase converts ACC to ethylene (Feng, Maguire, & MacKay, 2003b; Hamilton, Lycett, & Grierson, 1990).

Ethylene production rate in kiwifruit is low (0.1 to 1.0 µl/kg-hr at 20°C) and increases markedly with ripening to 50-100 µl/kg-hr. The rate of C_2H_2 production increase with maturity at harvest, physical injuries or mechanical damage caused during fruit harvesting and handling operations, infection by disease causing microorganisms, increased temperatures up to 30°C and water stress. Exposing the fruit to low humidity can result in sufficient stress to the fruit to initiate ripening. The ethylene production rates increased due to injuries and stress is temporary and returns to the level of the uninjured fruit (Hasey et al., 1994).

The rates of C_2H_2 production vary significantly among individual fruits upon transfer from storage at 0°C (32°F) to ripening conditions 20°C (68°F). Usually, the variation in rates becomes less and the time required for individual fruit to reach higher ethylene production rates becomes shorter and more uniform with increased storage time at 0°C (32°F). Kiwifruit placed at 20°C (68°F) without cold storage may take about 17±7 days to ripen while those stored at 0°C (32°F) take 6 months to ripen (Hasey et al., 1994). A study reported the influence of ethylene on the ripening and storage time of kiwifruit. The emission of ethylene increased during cold storage at 0°C, the increase being low during the first 2 months of storage and then accelerates quickly to reach the climacteric peak (Chiaramonti & Barboni, 2010).

Ethylene regulates the ripening, yellowing, softening, respiration and autocatalytic ethylene production of the fruit (Abeles, Morgan, & Saltveit, 1992; Sexton, Lewis, Trewavas, & Kelly, 1985). The increased rate of ethylene production is paralleled by an increase in internal ethylene concentration, thereby resulting in higher respiration rate, increased soluble solid content (SSC) because of starch hydrolysis while the acidity, mass and flesh firmness decreased (Chiaramonti & Barboni, 2010; Hasey et al., 1994). Harvested 'Hayward' kiwifruit dipped in solution containing the ethylene biosynthesis inhibitor solution LAB 181 508 (50 or 500μM) prior to storage at 0°C for up to 120 days reduced the production of ethylene during and after cold storage. The fruit firmness increased significantly and consistently over the course of the experiment (Retamales, Perez-Villarreal, & Callejas, 1995).

2.5.4 Compositional changes

Many compositional changes occur in the fruit after harvest until ripening. The compositional changes in the fruit are most commonly used to define the stage of maturity (Barboni, Cannac, & Chiaramonti, 2010). Kiwifruit are among the few fruits that retain high starch content at maturity. The starch content begins to decline with increase in soluble solid content. Starch hydrolysis continues after harvest, even while the fruit is being stored at 0°C (32°F) and it is essentially completed within few weeks of harvest (Hasey et al., 1994). Starch degradation for the formation of sugars is one of the major processes that mark the beginning of fruit ripening. Conversion of starch to soluble solids is slow in the first few days which then accelerate between 25 to 45 days of storage. Concentration of sucrose, fructose and glucose increased sharply between 30 to 40 days after harvest (MacRae, Quick, Benker, & Stitt, 1992).

The levels of hexoses are higher compared to sucrose. Glucose concentration is slightly lower than fructose initially, whereas in overripe fruit the glucose concentration exceeds fructose by 40% (Barboni et al., 2010; MacRae et al., 1992). Postharvest carbohydrate metabolism of kiwifruit during the ripening process shows concomitant declined levels of starch with a rise in the sucrose and hexoses (Okuse & Ryugo, 1981). By the time the fruit is edible, starch is no longer present and the sugar levels are approximately five-fold higher than at harvest (MacRae et al., 1992). Breakdown of the polysaccharide (starch) results in softening of the fruit and thereby a consequent increase in the susceptibility to mechanical injuries.

Change in the acid content of kiwifruit is desirable as it influences the development flavor, but loss of ascorbic acid leads to detrimental nutritional quality. Studies have shown that vitamin C content decreases in kiwifruit during long term storage under refrigerated conditions (Manolopoulou & Papadopoulou, 1998; Tavarini et al., 2008). The vitamin C concentration of ‘Hayward’ variety reduced from 200 to 37 mg/ 100g fresh weight after 6 months of cold storage (Tavarini et al., 2008).

2.5.5 Transpiration or water loss

Water losses can be one of the main causes of deterioration since it not only results in direct quantitative losses but also causes losses in appearance due to wilting and shrivelling, loss in texture quality (softening) and nutritional quality (Adato & Gazit, 1974). The dermal system (outer protective covering) plays an important role in the regulation of water loss by the commodity. The rate of transpiration is influenced by internal factors including morphological and anatomical characteristics, surface to volume ratio, surface injuries and maturity stage. The external or environmental factors include temperature, relative humidity, air velocity and atmospheric pressure (Burdon & Clark, 2001).

Kiwifruit is highly susceptible to water loss which leads to shriveling when kept under relative humidity (RH) below 92-95%. During storage at 0°C (32°F), the lower the relative humidity the greater the weight loss observed. Sun-exposed kiwifruit lose water at rate of 25-50% faster as compared to the shaded fruit. Excessive of brushing of fruits accelerates loss of water content. The use of polyethylene film liners or packing material helps in reduction of water loss during handling and storage (Hasey et al., 1994).

2.3.6 Physiological breakdown

Exposure of the fruit to undesirable temperature can result in the physiological breakdown of the product. Ethylene exposure at any level or carbon dioxide exposure at levels above 8% leads to various physiological disorders. Hard-core is one of the disorders in which the fruit core fails to ripen when the remainder of the fruit is soft and ripe (Lallu & Webb, 1997). The development of hard-core is seen when the fruit is stored for 16 weeks or longer at 0°C (32°C) in 14-20% carbon dioxide in air. Abnormal textural symptoms also occur when the fruit is placed in an environmental containing 85% carbon dioxide and 15-20% oxygen for 24 weeks at 0°C (Hasey et al., 1994).

Pericarp translucency is a disorder in kiwifruit that is most noticeable following post-storage ripening at 20°C and also observed when fruit is stored both in air and controlled atmospheric (CA) storage at 0°C (Crisosto & Kader, 1999). Translucent patches appear in the outer pericarp tissue at the stylar end which may be extended up the sides of the fruit. Pericarp translucency is more severe after prolonged storage and can be observed after 12 weeks of storage at 0°C. The presence of ethylene at 500 ppb or higher in the storage atmosphere exacerbates symptom development. The development of translucency is low under CA condition and is related to both low oxygen and elevated carbon dioxide levels (Hasey et al., 1994; Kader, Mitcham, & Crisosto, 1996).

The occurrence of granulation known as the pericarp granulation is predominant at the stylar end of the fruit which may extend to the sides of the fruit. This disorder is more severe with prolonged storage and after ripening at 20°C. Fruit stored at varying levels of carbon dioxide (0-7%) plus oxygen (2%) have similar levels of similarity as compared to the air-stored fruits. Addition of ethylene to the storage atmosphere results in greater number of affected fruits (Kader et al., 1996).

The white core inclusions (WCI) occurrence is directly related to the presence of ethylene in the CA and is not noted in fruits removed from CA or without ethylene in air storage. As a result of synergistic interaction between carbon dioxide and ethylene, the disorder appears to involve disruption of starch metabolism in the fruit core (Ferguson & Stanley, 2003). Symptom development closely parallels the rise of soluble solids content and decline in the starch content during the first 6-8 weeks of storage. The disorder results in distinct white patches core tissue which is obvious in ripe fruit. Threshold concentration for WCI development is less than 50 ppb ethylene and the temperature threshold is between 2.5°C to 5°C. These disorders or physiological breakdown leads to quality loss of the fruit (Crisosto & Kader, 1999).

2.5.7 Physical damage

Various types of physical injuries including surface injuries, impact bruising and vibration bruising are major contributors to deterioration. Mechanical injuries accelerate water loss, provide loci for fungal infection and stimulate CO_2 and C_2H_2 production. Bruised kiwifruit tissue becomes water soaked and browning of tissue is not observed due to the presence of high concentration of ascorbic acid (inhibitor of brown discolouration), low content of polyphenols and lower activity of polyphenol oxidase (Lallu, Rose, Wiklund, & Burdon, 1999). The influence of fruit firmness on the injury susceptibility was studied alongside with evaluation of fruit response to injuries. Both impact bruising (caused by dropping of the fruit) and abrasion or vibration bruising (caused by fruit movement during transport) have been evaluated. When fruit with 6 kgf (13 lbf) firmness was impacted, a light whitish bruise was observed. The white colour is a result of failure of injured cells to convert starch to sugar. But when a fruit with firmness as low as about 2.5 kgf (5 or 6 lbf) is impacted, a translucent bruise is seen. The injured flesh no longer contained starch. At an intermediate firmness between 6 to 2.5 kgf, no visual bruising was observed (Hasey, 1994).

Kiwifruit injured at above 6 kgf, flesh firmness did not show any physiological response in either CO_2 production or C_2H_2 production. However, below 6 kgf, impact bruising and vibration bruising stimulated respiration and ethylene production rates (Figure 2.5) which could be associated with accelerated deterioration. Vibration bruising of kiwifruit usually results in only minor signs of surface injury but severe flesh injury. A sharp increase in the production of ethylene is concurrent with the vibration bruising which persist for at least 1 week. Fruits with firmness lower than 2.5 kgf are more prone to such injuries. Opportunity for vibration bruising can be expected during transportation from pack house until the distribution market. Impact and vibration bruising stimulates respiration and ethylene production which may be associated with accelerated deterioration. Hence, it is essential to market kiwifruit at firmness above 2.5 kgf level (Hasey et al., 1994).

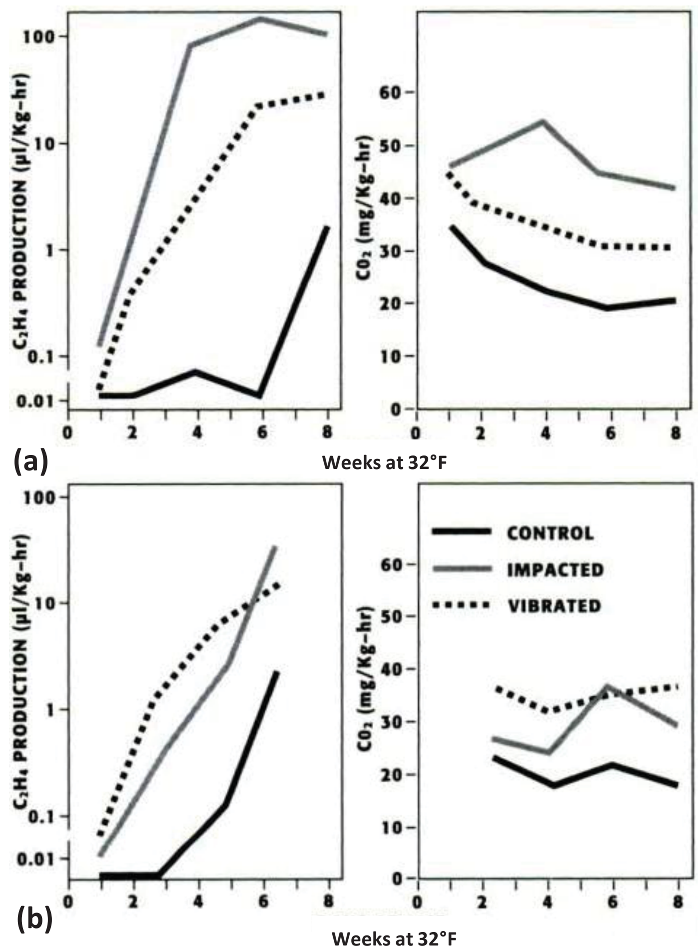


Figure 2.5: Average respiration (CO_2 production) and ethylene (C_2H_2) production by kiwifruit subjected to mechanical injury after (a) 4 weeks (at a flesh firmness of 5.3 kgf) and (b) 8 weeks (at a flesh firmness of about 2.5 kgf) in storage at 0°C (32°F) and 90% relative humidity (Source Hasey et al., 1994).

2.5.8 Pathological breakdown

One of the most common and obvious symptoms of deterioration results from the activity of bacteria and fungi. Usually, the microorganism attack follows physical injuries or physiological breakdown of the fruit. In general, harvest fruits exhibit considerable resistance to potential pathogens during most of their postharvest life. The onset of ripening and senescence results in their susceptibility to infection by pathogens. Mechanical injuries, chilling and sunscald lower the resistance against the pathogens (Crisosto & Kader, 1999).

Several pathogens can cause postharvest deterioration of kiwifruit. Botrytis gray mold rot caused by *Botrytis cinerea* is the most important which can directly invade the fruit or enter through wounds (Cheah, de-Silva, Irving, Hunt, & Tate, 1992). The symptom of this disease is development of soft rot starting at the stem end of the fruit. The affected area of the fruit becomes dark and water soaked. Even in the absence of decay, there might be superficial or white mold growth or grey brown spores (Cheah et al., 1992; Wurms, Long, Sharrock, & Greenwood, 1999). Moist conditions are necessary for infection, after which the fungus may remain quiescent for several months, appearing only after a period of storage. Alternatively, or in addition, infection can occur via the cut stem at harvest time and through wounds in the skin. Grey mold is capable of slow growth even at 0°C and during long term storage it can spread to healthy fruits causing nesting. As the fruit softens, it becomes more susceptible to *Botrytis* or other fungi. Maintaining the firmness of the fruits by rapid cooling, cold storage and use of controlled atmospheres for storage can significantly reduce the pathological breakdown (Sharrock & Hallet, 1992).

2.6 Environmental factors influencing fruit deterioration

2.6.1 Temperature

Temperature is the most important environmental factor that influences the deterioration rate of harvested commodity. It also plays an important role in the metabolism in fruits. Exposure to undesirable temperature results in physiological disorders including freezing injuries, chilling injury and heat injury. Temperature also influences the ethylene and carbon dioxide production and reduction in the oxygen concentration. Spore germination and rate of pathogen growth is also influenced by storage temperature. All these factors lead to the deterioration of the fruit or results in flesh softening thereby reducing the marketability (Hasey et al., 1994).

The optimum temperature for maintenance of quality in harvested kiwifruit is between -0.6 to 0°C (Harvey, Harris, & Marousky, 1983). Fruit held at 2.5°C (36.5°F) softens substantially faster than fruit stored at 0°C (32°F). The fruit held at higher temperature (5°C) softens much faster than the one held at 2.5°C (Hasey et al., 1994). Generally, the lower the storage temperature for the fruit down to its freezing point, the longer is the storage. The increase in the rate of deterioration is related to the metabolic processes of the fruit. Within the physiological temperature range of the fruit, the respiration rate increases exponentially with temperature. Hence for every 10°C rise in the temperature, the increase in metabolism is of the order of two to three fold (Thompson., 2003b). Cotter & MacRae (1991) conducted a comparative study on ripening, storage and sensory qualities of seven cultivars of kiwifruit. 'Hayward' kiwifruit were the slowest to soften at cold storage (Cotter & MacRae, 1991).

A study conducted by Lallu (1989), indicated that kiwifruit are best stored at 0°C and provided they stay clear of the fruit freezing point (-1.5°C or lower). Fruit softening rate increases with temperature above 0°C point and at 4°C storage life may be reduced by one month compared with the 0°C temperature. A 5°C rise in temperature can double the respiration rate and thus halve the storage life (Lallu, 1989). The flesh firmness of fruit (and therefore storage life) typically decreases curvilinearly with time, at a rate dependent on storage temperature. Even when the fruit is stored at 0°C, flesh firmness of fruit decreases rapidly and after about 6 weeks of storage between 1.5 and 3 kgf. The rate of softening slows at this stage and the minimum export firmness (1.0 kgf) is reached after about 16-20 weeks. The rate at which the fruit firmness decreases initially, and the time of transition to the stage of a gradual decrease in firmness, differs from year to year (McDonald, 1990).

2.6.2 Relative humidity

All fresh fruit lose water and therefore weight after harvest. When the weight loss of kiwifruit is more than 3-4%, this becomes evident trough shriveling of the skin (McDonald, 1990). Relative humidity influences the water loss, decay development, incidence of some physiological disorders and uniformity of fruit ripening. Condensation of moisture on the fruit over long periods is probably more important than the relative humidity of the environmental in enhancing the decay. Optimum relative humidity is between 85-95% for fruits (Kader et al., 1985).

Although the rate of moisture loss is influenced by the condition of the fruit, the temperature of the surrounding air, the flesh temperature and air velocity, relative humidity of the air around the fruit is the dominant factor affecting weight loss after fruit has been cooled and is being stored at 0°C. Once the fruit is packed into the export tray with its polyethylene liner, weight loss is greatly reduced, the sole function of the liner being it to act as a moisture barrier. Fruit that are stored without liners for any appreciable time (10-14 days in conventional cool store) at lower humitidities (below 85%) quickly begins to shrivel and become unsalable. Weight loss of 1% is observed in kiwifruit stored for 3-6 months at 0°C and 98-100% relative humidity (McDonald, 1990).

A study conducted by Burdon et al. (2007), indicated that storage of kiwifruits in bins increased fruit weight loss, but this could be reduced by the use of high humidity environments. For a 100g fruit, packed fruit lost 3.5 mg/day, binned fruit under high RH lost 11 mg/day and binned fruit under low RH lost 160 mg/day. Increased weight loss was accompanied by increased incidence of disorders, particularly when weight loss exceeded 1.5 to 2.5% (Burdon et al., 2007).

2.6.3 Atmospheric composition

Reduction of oxygen and elevation of carbon dioxide, whether intentional (modified or controlled atmosphere storage) or unintentional, can either delay or accelerate deterioration of fresh produce (Kader et al., 1985). The effects of atmospheres containing high carbon dioxide (CO_2) and low oxygen (O_2) on the storage life and quality of kiwifruit have been studied overseas and also in New Zealand. Controlled atmosphere (CA) storage is used commercially for kiwifruit bulk-stored in bins, to extend the packing season, and for kiwifruit packed in trays or bins, to allow greater flexibility for export market (McDonald, 1990).

The softening of kiwifruit during cool-storage in air has two distinct phases: the initial rapid phase during which fruit softens at a rate up to 1.5 kgf per week, followed by a longer period (slow phase) during which fruit firmness decreases by about 0.1 kgf per week. Storage trails have indicated that atmospheres containing more than 4% CO_2 retard the rate of softening in both phases. When the fruit were air-stored, firmness reached below 1.0 kgf (minimum firmness for export) after only 12 weeks of storage, while fruit stored in 8% and 10% CO_2 were still firm enough to be exported after 24 weeks (Harman & McDonald, 1982). Storage in atmospheres containing increased concentrations of CO_2 in combination with a low concentration of O_2 (1-3%) is more beneficial for both quality maintenance and storage life of kiwifruit. Generally, atmospheres containing 5-8% CO_2 in combination with 1-2% O_2 result in firmer fruit after cool storage than do atmospheres containing elevated levels of CO_2 in air(Harman & McDonald, 1983).

Park (1996) studied the shelf life of kiwifruit at room temperature and cold storage following controlled atmosphere storage. 'Hayward' fruit stored in CA for 60, 90,120 or 150 days, were placed at room temperature or in cold storage. The fruit quickly lost firmness after 20, 16, 14 and 10 days, respectively at room temperature and after 70, 60, 40 and 30 days, respectively in cold storage. At room temperature, ethylene and CO_2 production peaked after 4 days for fruit originally stored in CA for 120 and 150 days and after 6 days for fruit originally stored 60 and 70 days. These peaks were observed after 15 to 30 days for fruit in cold storage (Park, 1996).

The effects of modified atmosphere (MA) storage and ethylene absorbent on flesh firmness, soluble solid content, ascorbic acid, chilling injury and percentage fungal decay of 'Hayward' were evaluated by Pekmezci & Erkan (2004). The experiment was performed at 0°C and 90% RH using 50×70 cm polyethylene bags. Oxygen declined by 6-8%, and CO_2 increased to 7-9% in 6 months of storage. Fruit stored in MA with ethylene absorbent during storage, resulted in firmer fruit, higher titratable acid and ascorbic acid and lower weight loss than the control fruit. After a 6 month storage period, the highest percentage of marketable kiwifruit was obtained from the fruit kept at MA with ethylene absorbent (Pekmezci & Erkan, 2004).

2.6.4 Ethylene

The effects of ethylene on postharvest fruit can be desirable or undesirable. Ethylene can be used to promote faster and more uniform ripening of fruit picked at the maturity stage. Results have shown that harvested kiwifruit are very susceptible to ethylene and that concentrations of 0.1 µL/L (0.1 ppm), even at 0°C will increase fruit softening and reduce the storage life (McDonald, 1990).

'Hayward' is extremely sensitive to ethylene action even at low temperatures and this is of great importance for long-term storage. Kiwifruit respond to propylene at temperatures ranging from 15-34°C by advancing the onset of ripening and respiration, while ethylene burst occurs late in the ripening process. Below a critical temperature range (11-14.5°C), kiwifruit lacks the ability to produce ethylene even when treated with propylene (Antunes, 2007). Ethylene application at 4-10 ppm for 12-24 h accelerated ripening of 'Hayward'. As a result of ethylene treatment, fruit firmness, titratable acidity, and L and b Hunter colorimeter values decreased rapidly while degree Brix, pH and the 'a' colorimeter value increased slightly (Itoo & Hashinaga, 1985).

Brigati & Maccaferri (1983) studied the effect of ethylene on kiwifruit (earlier known as Chinese gooseberry) postharvest senescence. 'Hayward' kiwifruits were stored in cold storage (0°C) in normal atmosphere or with ethylene scrubber. Samples were analyzed at 45 day intervals over 6 months for weight loss, pulp firmness, soluble solids, ascorbic acid, titratable acidity and total sugars. Results revealed complete loss of firmness in normal atmospheres after 3 months, while ethylene scrubbers allowed marketing of 6 months old fruits. There was a gradual weight loss under all conditions. Sugar and soluble solids increased, ascorbic acid and titratable acidity decreased during storage under all conditions (Brigati & Maccaferri, 1983).

2.6.5 Packaging of kiwifruit

Packing is viewed as simply a convenience in achieving orderly marketing of fresh fruit. The shipping container provides a convenient unit to facilitate the transfer of the product from the point of production to the point of final sale or consumption (Kader, 2002). There are three important requirements in packing fresh fruits so as to protect them from deterioration during subsequent handling and distribution:

- Fruit must be immobilized within the container. Without immobilization, fruits can become injured as a result of movement during transit. Immobilization can be accomplished by wrapping and place packing of carefully sized fruit.
- Fruit must be cushioned against impacts. Impact bruises can occur during packaging as a result of unnecessary drops of fruits. After packing, impact bruises can occur as packages can be dropped during handling.
- Fruits must be protected from compression. Compression bruising can result from compression of overfilled containers, either during lidding or after stacking. Much compression bruising results from container failure after packing, a situation in which the fruit rather than the container, assumes the stacking stress (Kader, 2002).

In New Zealand, kiwifruit are packed into trays which consist of an outer case of either wood, cardboard or plastic, a perforated plastic pocket tray-pack, a polyliner, corrugated ‘strawboard’ and a cardboard lid. All the fruit in a tray are of the same size and the average total weight of fruit per tray is 3.6 kg. There is a range of eight designated fruit sizes, from 25 to 46 fruit per tray with a pocket tray-pack to suit each size. The case, pocket pack, corrugated strawboard and lid protect the fruit from mechanical damage and the polyliner provides localized high humidity which reduces fruit deterioration (McDonald, 1990).

Feng et al. (2003) investigated the effect of package on physiochemical attributes of 'Hayward' kiwifruit. In this study the fruit were packed in modulated pulp trays or single-layered kiwifruit trays with polyliner. Temperature and weight loss of these fruit were recorded after shifting from a cool storage (0.5°C and 80-90% RH) to an air conditioned laboratory (20°C and 50-60% RH). Results indicated that respiration and ethylene production increased rapidly in the modular trays as compared to single-layered kiwifruit trays (Feng, Maguire, & MacKay, 2003a). Another study was conducted by Hong et al. (1994) on effect of polyethylene film and low temperature on the quality of kiwifruit during storage. 'Hayward' kiwifruit were stored at room temperature (25°C) for up to 5 weeks, half in polyethylene film and half not. Shelf life of control was only one week whereas packed fruit remained in good condition for 2 weeks. The fruits were also stored at 2°C for 6 months with or without packaging in polyethylene film. The shelf life of control was one month, that with 0.6 or 0.10 mm film was 3 months and that with 0.03 mm film was 5-6 months. Fruit firmness declined rapidly during the first month, particularly in fruit packed in thicker film (Hong & Lee, 1994).

2.7 Transportation, handling and distribution of kiwifruit

Consumption of fresh produce has been historically highly seasonal. With improvements in refrigeration, transport and storage facilities allowing highly perishable products to be shipped to distant countries consumers can expect a near complete range of produce to be available year-round (Saunders & Hayes, 2007). In the food industry, the system that moves a steady supply of fresh produce is simply called the "cold chain". The cold chain encompasses all the critical steps and processes that food and other perishable products must undergo in order to maintain quality. Therefore, logistics play a central role in ensuring an efficient cold chain from the field through the distribution channels, to the home refrigerator. In addition to examining these requirements at local levels, the intricacies of transcontinental shipment, customs requirements, air and sea freighting and special packaging add complexity to the logistics (Ezeike & Hung, 2009).

Kiwifruit protection during transportation and distribution is similar to that during storage and handling. With advancing postharvest age the fruit becomes more severely affected by abuses that occur during this period. Thus, attention should be must be given to ethylene avoidance, temperature management, protection against water loss and avoidance of various mechanical injuries (Hasey, 1994). If kiwifruit are impacted during loading or unloading, the chances of bruising are high Impact of bruising of firm kiwifruit, in which the starch has not been fully hydrolyzed, appears as a white since the starch in the injured tissue has not been converted to soluble sugars (Banks, Dingle, Davie, & Mowatt, 1992). Soft kiwifruit, in which the starch hydrolysis is largely complete, develop a dark, water soaked bruise as a result of cell rupturing. Fruits that soften under 5 lbf (2.27 kgf) becomes especially susceptible to injury from transport vibration and lesser the fruit firmness, greater is its susceptibility to injury (Lallu et al., 1999). Although it would be desirable to restrict marketing to more firm fruit, this would limit the potential air storage life of 'Hayward' kiwifruit to about 4 months and only CA-stored fruit would be sufficiently firm to be marketed beyond this stage (Hertog, Nicholson, & Jeffery, 2004).

Injuries to soft fruit during transportation and distribution not only lower the fruit value due to visual damage, but injured fruit immediately respond with elevated respiration and ethylene production. This in turn stimulates elevated respiration of surrounding undamaged fruit, and hence all fruit show accelerated physiological and physical deterioration (Lallu et al., 1999). In addition, injuries become an avenue for the spread and development of fruit rotting organisms. When the fruit-rotting organisms, especially *Botrytis cinerea*, becomes well established in one fruit, it spreads to the surrounding fruit and the incidence of rotting fruit quickly escalates (Cheah et al., 1992). Further, these infected fruit respond to infection by elevating their level of physiological activity leading to the production of more ethylene and causing rapid softening of healthy fruits.

The supply chain system

Supply chains are all about linkages and a supply chain is only as strong as its weakest link. In a supply chain there are many interfaces (links), such as those between customer and retailer, producer and packing house. Problems develop at these interfaces and the best way to overcome such problems is by managing the supply chain efficiently. Major limitations experienced by the cold chain include poor temperature management, due to either the lack of, or limitations in refrigeration, handling, storage and relative humidity control. Temperature management during transportation of fresh produce over long distances is critical. Stacking of loads should be done in such a way, so as to provide proper air circulation, in order to facilitate removal of heat from the fruits as well as dissipate incoming heat from the atmosphere. Minimizing mechanical damages should also be considered during stacking of loads. Temperature maintenance throughout the handling system helps in maintaining fruit quality (Christopher., 1992).

Logistics is the process of planning, implementing and controlling the efficient flow and storage of goods, services, and related information from the point of origin to the point of consumption, to meet the customer's requirements (Luo & Findlay, 2002). According to Tarnowski (2006), the biggest problem is that the players cannot see past their own concerns. Improved communication and information exchange can achieve better cohesion (Tarnowski, 2006). Christopher and Lee (2001) acknowledge the inherent complexity of inter-organisational supply chain networks, promoting the virtues of 'visibility' and 'velocity' as the key elements to improve the supply chain. 'Visibility' implies a clear view of upstream and downstream inventories, demand and supply conditions, and production, and purchasing schedules. The achievement of supply chain visibility is based upon close collaboration with customers and suppliers, as well internal integration within the business. The second ingredient of supply chain agility is 'velocity', which refers to 'end-to-end' pipeline time, i.e. the total time taken to move products and materials from one end of the supply chain to the other. The three basic foundations for improved supply chain velocity and acceleration are streamlined processes, reduced inbound lead-times and non-value added time reduction (Christopher & Lee, 2001).

Important factors for consideration

According to Fearne and Hughes (1999) a number of driving forces are evident to varying degrees, for success of the supply chain. These include: continuous investment (despite increasingly tight margins), good staff (to drive the process of innovation and develop good trading relationships with key customers), volume growth (to fund the necessary investment and provide a degree of confidence in the future), improvement of measurement and control of costs (in the pursuit of further gain efficiency) and innovation (not just in the product offer, but also in the level of service and the way of doing business with key customers) (Fearne & Hughes, 1999).

There is increasing attention on product traceability, particularly for produce, to assist with product recalls and bioterrorism. However, conventional barcodes for labelling shipped produce are still used extensively. It is now globally important that the ability to trace backward and forward information about production and postharvest handling operations should be a part of good agricultural practices (GAPs). In the process, greater certainty regarding quality, delivery options and intervention measures along the entire food chain can be achieved (Christopher & Lee, 2001). Bollen et al. (2006) discussed the need for traceability in the fresh produce chain. They contend that a good traceability management system will allow product to be traced to any point in the supply chain, in the event that a recall is required or there is an issue of quality. New concepts have been developed to enhance the quality of the information captured to be even more efficient and relevant to current operations (Bollen, Ridden, & Opara, 2006).

The development of a market oriented produce supply chain is a major challenge in developing countries, and some of the constraints faced by the stakeholders are directly linked to the specific characteristics of the fresh produce. Producing fruits and vegetables is considered risky because of the relatively high investment costs, wide market price fluctuations and high perishability of the produce, among other factors (Rolle, 2006b). Major barriers to implement cold chain logistics, especially in rural settings, is the integration of all requirements. For example, the fragmented nature of the "fledging" Asian vegetable industry is due to the primary distribution areas being diversely located through the eastern and western seaboard. The Asian distributors often have non-English speaking background and consequently transfer of technology needs special attention. The infrastructure for optimum postharvest handling of crops is not often currently available for use in rural communities of Asia (Rolle, 2006b).

Minimal processing is one way to add value to fruit and vegetable and address perishable nature of fresh products. The perception of consumers of fresh, nutritious, convenient, ready-to-use products is making these commodities popular. Improvement of postharvest practices to deliver fresh fruit in optimum conditions to consumers complements cold chain logistics. The value of whole, fresh fruits often does not justify the use of quicker, but far more expensive, transportation and distribution systems. The USDA Agricultural Trade Office (ATO) worked with the USDA-FAS Emerging Market Office to help developing countries to build and improve their cold chain systems. The activity included building a cold chain program in China that helps local logistics providers improve the capability to handle temperature-sensitive imports (Thompson., 2003b).

2.7.1 Logistics and supply chain management

In many countries competition in the produce industry is fierce. In order to be successful, one strategy is to compete on quality, not on price. One of the key factors is to maintain the integrity of cold chain, as many perishable commodities are damaged at the slightest fluctuations in temperature. Ideally, a warehouse should be fitted with one or more multiple drive-in chill rooms, equipped with a container hoist and digital scales with ach chill room able to operate at different temperatures to cater for different product requirements (Ezeike & Hung, 2009).

To achieve full temperature control, one of the most important issues is the integrity of the cold chain. Cold chain logistics may be best defined as the maintenance of produce temperature throughout the demand-supply chain from harvest to the consumer. Poor cold chain management will have a negative impact on the product quality, especially delicate, perishable produce such as horticultural products. Softening, bruising, unwanted ripening, bacterial growth and textural degradation can all lead to spoilage of the product supplied (Tao, 2003).

For example, a product like broccoli takes 39 steps along the cold chain with as many as 23 operators and 21 stages involved along the way to reach its consumer. Logistics management has become so crucial that to have the situation under control, businesses have to plan the flight and fly the plan. Murphy (2005) reported that to maintain product integrity, produce must be maintained within very close temperature limits under fluctuating temperature environments. For example, bagged lettuce has become a staple in most grocery stores in US. As the product distribution network and geographic range expanded, so has the logistic challenges. However, this produce must be picked, washed, packaged and shipped within a matter of days in order to ensure that it reaches the customer while still fresh. Maintaining the proper temperature is critical as well as ensuring that the bags do not get crushed on the way (Hellickson, 2003).

The key to success requires that the produce maintains cold and consistent temperature across the entire life of the product (Murphy, 2005). With a short shelf life, speed of delivery and visibility are key success factors in ensuring how to know precisely where the product is at all times and how long it has been since the product is picked. The guiding rule of thumb for getting the product out of the warehouse is using the principle of FIFO (first in, first out) and FEFO (first expire, first out) processes (Ezeike & Hung, 2009). To ensure produce quality and shelf life, an unbroken cold chain must be maintained. The other important factor which needs to be controlled along the supply chain is the moisture content of the product. For example, a moisture control liner developed by CSIRO (Commonwealth Scientific and Industrial Research Organisation) from Australia is a simple bag that fits inside a normal carton or box. By keeping the humidity high, these liners can reduce the moisture loss significantly during long-distance transport. Simple wraps could be used on pallets of properly cooled fruits that are to be carried at non-ideal temperatures and double the time the produce temperatures remains in the required range. The freight transportation network is complex, yet at the end of the day, customers would only judge performance by the products delivered. It is the physical transfer of the product in a manner that not only maintains quality and condition, but also meets the timeframes required by the customer, that determines the survival of the business (Ezeike & Hung, 2009).

2.7.2 Refrigeration and cooling systems

As reported in various studies (Ferguson & Stanley, 2003; Heyes et al., 2010; Manolopouplou & Papdopoulou, 1997), lowering the respiration rate of fresh fruits is essential to preserving market quality. The most important technology for lowering respiration rates is proper cooling of produce within hours of harvest. Proper cooling preserves the product quality by inhibiting the growth of decay-producing micro-organisms; restricting enzymatic and respiratory activity; inhibiting water loss; and reducing ethylene production. In general, harvesting done in the early morning hours minimizes field heat and its exposure to the sun. Cooling produce to storage temperatures before packaging and transportation is important. Refrigerated loading and unloading should be used. Transportation trucks should be cooled before loading, and load pallets should be loaded towards the center of the truck. Insulating plastic trips should be used in the truck and in the loading docks. Produce should be moved rapidly to the storage area, at the appropriate temperature, and displayed at the appropriate temperature range (Hellickson, 2003).

All fresh horticultural crops are living organisms, even after harvest, and they must remain alive and healthy until they are either processed or consumed (Hellevang, 2003). The energy needed for living comes from the food reserves in the product itself. The process by which the reserves are converted into energy is known as respiration. Heat energy is released during respiration, but the rate varies depending on the type and variety of the product, the level of maturity, the amount of injury and the product temperature. Product temperature has the greatest influence on respiratory activity. Rapid, uniform cooling after harvest lowers the respiration rate which in turn reduces the rate of deterioration and help provide longer shelf life. Lowering the temperature also reduces the rate of ethylene production, moisture loss (wilting or shrivelling) and growth of micro-organisms. The resulting economic loss exceeds the increased cost of expedited handling of produce by more frequent deliveries from the field to the cooling facility for initiation of forced air cooling. This is not true for all crops, but is especially true for highly perishable produce in hot weather (Ezeike & Hung, 2009).

Room-cooling means produce is simply placed in a cold storage room and cools slowly and non-uniformly, mainly through conduction and natural convective contact with refrigerated air. However, cold room is normally used to store previously cooled produce and does not have the capacity to remove the heat from the un-cooled produce. Most cold rooms will increase in temperature after each fresh batch of warmer produce is added. Forced-air cooling can quickly remove field heat from freshly-picked produce. High capacity fans are used to pull refrigerated air through the produce (Ezeike & Hung, 2009). Rapid and uniform cooling is achieved by the forced-convective contact of the high speed, refrigerated air with the warm produce. Pulling air rather than blowing it through is preferable, because air flow is more uniform using this method. With proper container design and orientation, produce can be rapidly and uniformly cooled in baskets, boxes, bins, or bags. Forced-air cooling simply does a better job with refrigerated air in cold storage (Ezeike & Hung, 2009).

Hydro-cooling occurs by flowing chilled water over the produce and rapidly removing heat. It is usually at least ten times faster than forced-air cooling in removing heat from the produce, but is less energy efficient. This cooling is not suitable for produce that is delicate and sensitive to wetting such as most berries. The other method of cooling is top-icing, in which crushed ice is placed over the produce in boxes or containers, where liquid icing injects slurry of water and ice into the produce packages (Ezeike & Hung, 2009). This is an effective method for dense produce such as broccoli that cannot be cooled easily by forced-air cooling. Vacuum cooling can be obtained by placing produce inside a vacuum chamber and applying vacuum, causing water to evaporate from the produce surface and hence lowering the produce temperature. It is an effective method for produce with a high surface-to-volume ratio, such as leafy vegetables. Wilting due to moisture loss during vacuum cooling can be prevented by pre-spraying produce with water (Thompson., 2003a).

Field heat must be removed quickly from kiwifruit after harvest as the fruit can lose water rapidly. After 3-4% water loss, the fruit may exhibit noticeable shrivelling, predominately at the stem end. As with all fresh fruit, the rate of water loss is directly related to the vapour pressure difference between the fruit and its environmental (Thompson., 2003a). Temperature and relative humidity control this vapour pressure difference. In warm field temperature with low relative humidity common during harvesting, the rate of water loss can be 25 to 50 times greater than at the recommended 0°C (32°F) and 95% relative humidity in a kiwifruit storage room. Thus, one hour in the field after harvest may result in as much as water loss as 1 or 2 days in storage room (Hasey et al., 1994). Another reason to rapidly cool kiwifruit after harvest is based on the kiwifruit's propensity to rapidly soften after harvest. The softening process in kiwifruit is temperature dependent. For example, fruit softens three times faster at 5°C (41°F) than at 0°C (32°F). Rapid heat removal helps minimize flesh softening during subsequent 0°C storage if the flesh is not exposed to ethylene during cooling (Thompson., 2003a). Hydro cooling of kiwifruit is not recommended as prolonged wetting of the fruit reportedly worsens the occurrence of decay. Forced-air cooling, widely used on other fruits is preferred for rapid cooling of kiwifruits. This involves creating a slight pressure difference on opposite sides of bins or pallets to cause cold air to flow through side ventilation openings in the container to rapidly cool the fruit. The intimate contact between cold air and warm fruit results in rapid heat removal (Hasey et al., 1994).

Many factors influence the rate of cooling which include:

1. the density of produce in the container (less dense the produce pile, the faster the cooling);
2. the container type, orientation and venting (if air passes uniformly and evenly around the produce, cooling is faster);

3. the volume and surface area of the produce (lower the ratio, faster is the cooling, example; cherries cool quicker than melons);
4. the travel distance of the cooling air (shorter the distance, faster the cooling of the overall pile); and
5. the capacity of airflow (the higher the air flow, faster the cooling).

The '7/8' cooling time is standard industry term that describes the time required to remove seven-eighths (87.5%) of the temperature difference between the starting produce temperature and the temperature of the cooling medium (refrigerated air, in the case of forced-air cooling). It is a convenient method of indicating when the produce has come as close as practical to the temperature of the cooling medium (Ezeike & Hung, 2009). The cooling of kiwifruits should be in a similar manner as cooling of plums. Crops with high respiration rates (asparagus, broccoli, leaf lettuce, spinach, sweet corn, mushrooms) at harvest temperature must be cooled rapidly and quickly (less than 90 minutes) after harvest. Crops with high respiration rates at harvest temperatures (blueberries, raspberries, strawberries, sweet cherries, cauliflower, snap beans, head lettuce) should be forced-air cooled as quickly as it is practical (less than 3 hours) after harvest. While crops with low or moderate respiration rates at harvest temperatures (apples, kiwifruit cabbage, cantaloupes, celery, peaches, plums, peppers and squash) can be cooled within 4-5 hours of harvest to avoid quality loss (Ezeike & Hung, 2009).

2.7.3 International transportation or freighting

Fresh produce has been historically grown in areas where quality and yield can be optimised. Since great distances often separate high population bases from seasonal production areas, transcontinental and transoceanic shipments of produce by air, land and sea have been necessary. Advanced cultural and production practices coupled with improved fruit cultivars have contributed to superior quality at harvest and increased yields (Brecht, Dohring, Brecht, & Benson, 2009). Accordingly, millions of pounds of fresh fruits are produced annually in every corner of the world. Much of this produce can be successfully sold and shipped to foreign markets via land and ocean transportation when the right blend of climate control technology and services available to shippers, buyers and transporters (Brecht, 1980; Brecht et al., 2009).

The full impact of these horticultural improvements can only be realised at the wholesale, retail and consumer level, if the product spoilage and deterioration are minimised during distribution. Concomitantly, global demand for fresh fruits and vegetables has continued to grow due to the consumers' demand for wholesome and fresh produce (Brecht et al., 2009). Furthermore, the consumers' desire for previously under-exploited fruits and vegetables from distant production areas has been augmented by more disposable income and an evolving appreciation for the nutritive value of fresh produce. As a result, hundreds of thousands of loads of fresh produce have been shipped around the world, via land and ocean, in refrigerated intermodal containers called "reefers" (Tanner & Smale, 2005).

Air transportation is a solution for distributing high value and short shelf life fresh produce to world markets (Pelletier, Nunes, & Emond, 2005). Air transport is quick but expensive in comparison to land and sea transport. In land and ocean transport, use of multimodal refrigerated containers with computer-based controllers and atmosphere management are incorporated (Pelletier et al., 2005). The transit times to distant markets are much longer than air transport. The extended times in transit require that optimum temperature and atmosphere management be maintained to prolong shelf life and to deliver consistent quality produce to world markets (Silva et al., 2003; Thompson, Brecht, Hinsch, & Kader, 2000).

2.7.4 Temperature maintenance and monitoring of fruit during transportation

Refrigerated transportation for perishable commodities is a mature technology, having been used for over 100 years (Brecht, 1980). In recent years, technological advances in the design of insulated trailers and marine container along with their refrigeration control systems have markedly improved the operation and reliability of the controlled temperature/atmosphere in the transport vehicles. Many of the improvements have been in information technology and sensors (Thompson & Brecht, 2005). In the last two decades, temperature control has improved significantly through smarter defrost cycles, improved air distribution, improved reliability, and microprocessor controls (Brecht et al., 2009). Computer-based controllers now automatically check, diagnose and record the operating conditions of climate control equipment and the temperatures, humidities and atmospheres can be adjusted based on a product database stored in the computer or available from published guidelines (Thompson & Brecht, 2005).

The technological advances in microprocessors-driven refrigerated containers for transoceanic and overland transport have opened up a new era of produce distribution to overseas markets with transit times often greater than those encountered in domestic trade routes (Brecht et al., 2009). Additionally, longer transit times, higher energy costs and rapidly increased volumes of produce have triggered new developments and improvements in climate control technology. Shipper and receivers of fresh produce have witnessed improvements related to supplements to temperature control such as atmosphere, humidity and ethylene (C_2H_2) management and improved fresh air ventilation and air circulation (Silva et al., 2003). The ability to deliver fresh and wholesome produce to consumers by managing the climate within the reefer containers can potentially result in financial rewards to growers, exporters, transporters, and importers. The most significant challenge for exporters is to deliver consistently fresh quality produce to distant markets at an affordable and competitive landed cost.

Temperature management plays the most significant role for extending the shelf-life of the product. Bringing the product to its desired carrying temperature as quickly as possible is paramount for global distribution (Silva et al., 2003). Meanwhile, altering the container's atmosphere to desired levels as a supplement to good temperature control can potentially add days or even weeks to the shelf life of a larger number of fruits and vegetables, thereby allowing the produce to travel longer distances and bringing greater selection of produce to consumers around the world. When shipping fresh produce in reefer containers, special packaging and loading practices are required. Proper product packaging, carton designs, utilisation and stowage are needed to ensure that the conditioned air is capable of evenly and effectively removing heat while maintaining non-injurious or beneficial levels of gases such as carbon dioxide (CO_2), oxygen (O_2) and ethylene (C_2H_2) within the load (Silva et al., 2003).

A reefer container is made up of an International Standards Organization thermal (insulated) container, typically 20 or 40 feet long, with a refrigeration system on the front wall of the container(Thompson et al., 2000). Containers offer superior temperature control by delivering pressurized, conditioned air through the chilled produce load. Container refrigeration systems are designed to optimally maintain the product temperature during transit (Dohring, 2006). Therefore, the product needs to be fully pre-cooled prior to being loaded into the container. Produce loaded 'hot' or 'warm' tend to lose quality attributes, shelf life and weight during the potentially slow temperature pull-down process (Thompson et al., 2000).

2.7.5 Distribution and marketing of kiwifruit in India

Extending between 8°4" and 37°6" N, and 68°7" and 97°25" E, India, a subcontinent covers 3.29 million km^2 that is 2.4% of the world land area. Rainfall patterns vary across the subcontinent and there are six broad climatic types, from arid desert to alpine to humid tropical (Johnson, Weinberger, & Wu, 2008). The four seasons are as follows: winter (January-February), summer (March-May), monsoon (June-September) and post-monsoon (October-December). The Himalayas block the winds from the north, hence the winters in India are milder while the summers are hot. This climate is essentially "tropical" for much of the subcontinent aside from north-eastern area and the Himalayan foothills (Johnson et al., 2008).

The tropical climate of India is one of the causes for postharvest losses of fresh produce. The losses are high, probably enough to feed 20% of the country's population. According to the Indian Government, $14.3 billion (US dollars) worth of perishable and durable agri-produce is wasted. Wastage occurs at various stages due to the fragmentation of the supply chain, deficiencies in Agricultural Produce Marketing Act and inadequate infrastructure (Johnson et al., 2008). Rolle (2006) indicated fresh produce losses ranged from 10 to 40% globally, with losses in India at the high end. Logistics are generally inadequate and in need of improvement. Improvements to technology and infrastructure are critical for improving cost efficiencies in the produce industry (Rolle, 2006a). The government has a key role in the provision of improved transport and infrastructure, and the private sector can play a significant role in terms of system improvement, technology adoption and infrastructure access (Johnson et al., 2008).

Marketing fresh produce: wholesale and retail sector

Wholesale: Development of the produce industry is constrained by poor marketing arrangements. At these wholesale markets the produce are sold to consumers or processors or assembled further for a distant market. These markets involve well-organized merchants and are located in the major cities (Bangalore, Delhi, Mumbai, Chennai and Kolkata) (Vasant & Namboodiri, 2004). The Indian government has aimed to control produce marketing through 'regulated' markets to encourage greater transparency and fair business. There are about more than 7,000 of these markets with state government-enacted Agricultural Produce Marketing Regulation legislation regulating competition, transactions and market charges (Vasant & Namboodiri, 2004).

Although the laws have improved market function, reduced costs for producers/sellers and provide framework for regulation and consultation, the agricultural marketing system is very inefficient. The government regulated monopoly on wholesale markets has prevented development of competitive marketing, failed to help farmers in direct marketing, retailing, or the supply of produce for processing and prevent innovation in marketing and technology use. Currently, the wholesale markets are dominated by a small number of traders. Transactions lack transparency and handling facilities are poor. Wastage is high due to poor logistics and lack of cold chain facilities (Johnson et al., 2008).

Retail: Over the last decade, the Indian retail sector has expanded rapidly with the retail food sector growing at 5% with sales of US$ 168 billion in 2005. Small independent retailers dominate 99% of the retail food sales, with most advantage of supplying low-income products that are affordable for most people, with convenient locations, local and import produce supply, and loyal customer followings (Johnson et al., 2008). By contrast, supermarkets and modern retail stores have until recently occupied only 1% of the market. In the areas where the supermarkets have opened, local vendors (small stalls, peddle carts and pavement sellers) are reported to be losing 40% of their business. But the change to supermarkets is led by customer demand and will revolutionise produce handling (Johnson et al., 2008). Thus, the complexity of the Indian market leads to high fruit loses.

2.8 Kiwifruit softening during postharvest period

When kiwifruit are harvested they generally have firmness in the range of 11 to 6 kgf but would not have attained eating ripeness until the firmness drops below 1 kgf. The two phases of the drop in firmness after harvest are the rapid (A) phase and the slow (B) phase (Figure 2.6). In the rapid phase, the firmness of the fruit drops rapidly and the largest changes take place in this phase. The second phase, starting at about 2 kgf represents a slow decrease until the fruit are 'overripe' (Jordan & Loeffen, 2009). Early season fruit shows a lag period immediately after harvest where little firmness change occurs before the fruit moves into the rapid phase. The lag phase is not apparent in the late season harvests. The implications of this are that fruit harvested early and stored for a short period will be firmer than fruit harvested later and stored for the same period. The duration of phase B appears to be shorter for early harvest fruit while late harvested fruit will be softer at harvest and retain firmness longer (MacRae et al., 1992).

Starch hydrolysis occurs mainly in phase A and probably makes some contribution to overall softening. It is during phase A that large amounts of the pectins in the cell walls are solubilised and the hemicelluloses reduce in size with a concomitant reduction in the integrity of the cell walls. By the time phase B is reached, most of the pectin gets solubilised but the reduction of the pectin chain length continues through phase B. At the end of the slow phase the middle lamella is mostly disintegrated (MacRae et al., 1992).

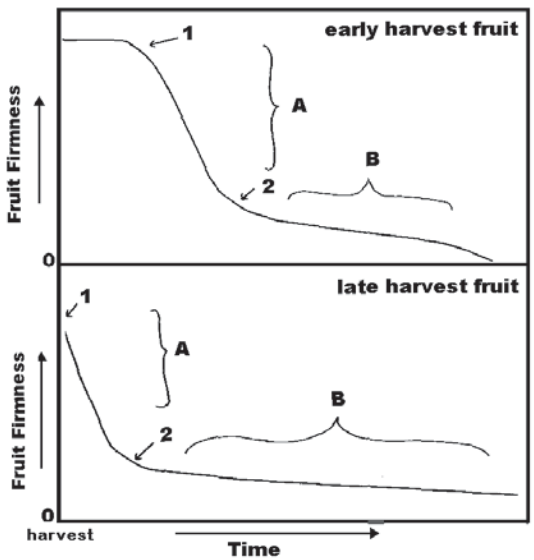


Figure 2.6: Softening phases of early and late harvest kiwifruit (Source: MacRae et al., 1990).

Beever (1993) reported some patterns of softening. Ripening occurs rapidly at ambient temperature, especially in the presence of ethylene. It occurs more slowly at lower temperature, and even at 0°C, the initial softening progresses rapidly (Beever, 1993). Harker and Hallet (1993 and 1994) investigated changes in kiwifruit flesh firmness at the cellular level using tensile strength measurements and low-temperature scanning electron microscope (SEM). It was proposed that the rapid phase reduction in flesh firmness (from 8.0 to 2.7 kgf) was related to the reduction in the strength of bonds or adhesion between neighbouring cells. Tensile tests completed before this phase caused cells to break through their middle, indicating strong cell-to-cell adhesion (Harker & Hallet, 1993). After the rapid phase completion, cells get separated during the tensile tests, indicating cell-to-cell adhesion is lower than cell wall strength. As firmness decreases from 2.7 to 0.5 kgf there is an increase in the proportion of the cells that separate at the middle lamella and an increase in the plasticity of the cell wall. It is this second firmness drop that is more critical as it is in this phase that the fruit pass through the critical 1 kgf threshold (Harker & Hallet, 1994).

2.9 Prediction of kiwifruit softening using mathematical models

Various mathematical models exist in literature for predicting the storage life of kiwifruit (Jordan & Loeffen, 2009). Many researchers have used mathematical or algebraic descriptions of the trends of softening experienced by kiwifruit over their life from vine to consumer's plate. These models are said to be monotonic, i.e. they generate curves that are always decreasing which is consistent with the subject matter knowledge of fruit getting softer during storage (Jordan & Loeffen, 2009).

Simple exponential model

The Simple Exponential model takes the form:

$$FF = A_0 + A_1 e^{-\lambda t} \qquad (1)$$

In equation 1, *FF* represents flesh firmness, A_0 represents the lower asymptotic value, A_1 represents the drop in the firmness from the initial value to the lower asymptote, λ represents the relative rate of decline with time and *t* the number of days in storage (Benge, Banks, & Jeffery, 2000). This model describes only the rapid phase (A), does not have a plateau above zero and predicts firmness that gradually slides directly to zero (Figure 2.7).

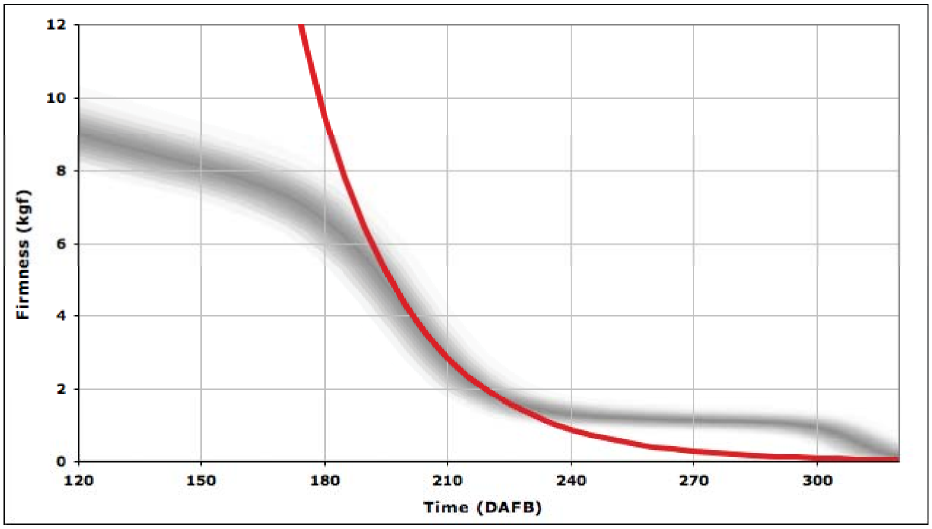


Figure 2.7: Simple Exponential Model in predicting kiwifruit softening curves (Source: Jordan & Loeffen, 2009).

Boltzmann model

The Boltzmann model form is also known as the logistic sigmoid function or logistic sigmoid growth curve (with time reversed) and is the function usually described as a sigmoid. A number of physiological processes respond in a Boltzmann fashion, which is the form:

$$FF = A_0 + \frac{\Delta A}{1 + e^{(t-t_k)/\lambda}} \qquad (2)$$

In equation 2, FF is the flesh firmness, A_0 represents the lower asymptote, ΔA represents the difference between the upper and lower asymptote, t the time after harvest (days), t_k is the time in days for the firmness to drop by $\Delta A/2$ from the upper asymptote, λ is relative rate of decline with time (White, de-Silva, Requejo-Tapia, & Harker, 2005). This model focuses on the rapid phase (A) but clearly identifies transition from phase A to B (slow phase) (Figure 2.8) (Jordan & Loeffen, 2009).

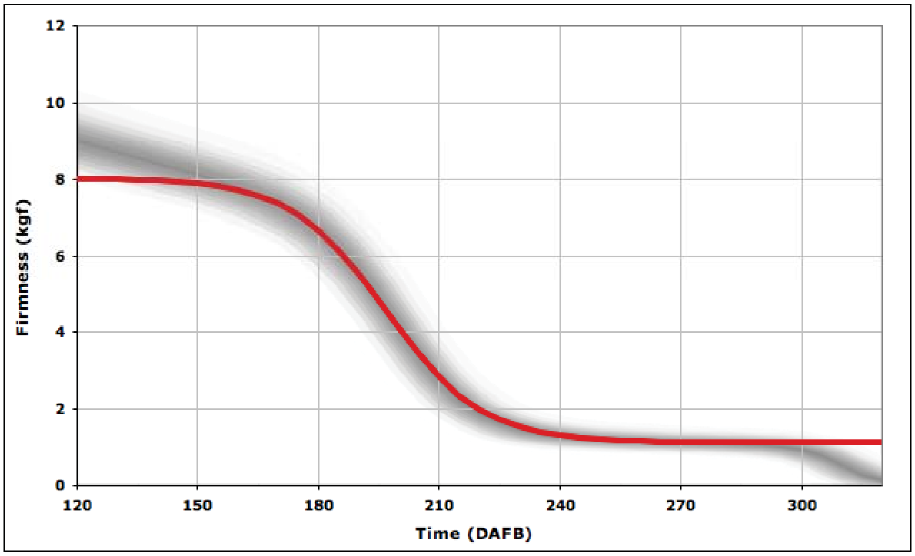


Figure 2.8: Boltzmann Model in predicting kiwifruit softening curves (Source: Jordan & Loeffen, 2009).

Inverse Exponential Polynomial model

The equation for Inverse Exponential Polynomial Model is in the form:

$$FF = \frac{\delta}{1 + e^{(\beta_0 + \beta_1 t + \beta_2 t^2 + \beta_3 t^3)}} \qquad (3)$$

In equation 3, *FF* represents the flesh firmness, δ is the scale parameter, β represents the horizontal shift parameter and t represents the number of days in storage (Benge et al., 2000; White, de-Silva, Petley, & Harker, 2007). This model has the basic form of Boltzmann Model but with a cubic rather than a linear function of time in the exponent (Jordan & Loeffen, 2009) (Figure 2.9).

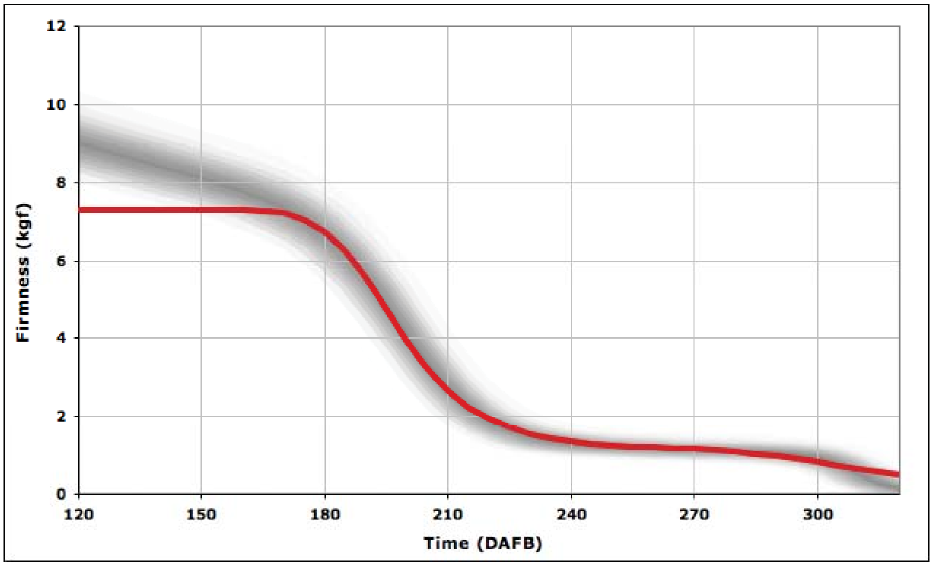


Figure 2.9: Inverse Exponential Polynomial Model in predicting kiwifruit softening curves (Source: Jordan & Loeffen, 2009).

3.0 MATERIALS AND METHODOLOGY

The information provided in sections 3.2 to 3.5 are the standard procedures of postharvest processing of kiwifruit used by Zespri International Ltd. Although analyses of fruit were not conducted in these sections, the information described in section 3.2 to 3.5 were provided by Zespri International Ltd for use in this study.

3.1 Fruit selection

Green kiwifruit (*Actinidia deliciosa*), commercially known as the 'Hayward' variety was selected for this study as it is the standard cultivar of international commerce of kiwifruit (Ferguson & Stanley, 2003; Nishiyama, Yamashita et al., 2004; Perera et al., 1998). Fruit used in this study were grown in the regions of Bay of Plenty, New Zealand and the fruit were harvested when the soluble solids content (SSC) was between 6.5-7.5% (Brix). The levels of soluble solids content are the recommended maturity index for harvest of kiwifruit (Crisosto & Kader, 1999; Ferguson, 1990b; Gerasopoulos, Chlioumis, & Sfakiotakis, 2006; Hasey et al., 1994; Park et al., 2006). After harvest, the fruit is transported to the pack house on the same day.

3.2 Curing of kiwifruit

Once the fruit was delivered to the pack house, they were stored in covered curing rooms at ambient temperature (21±2°C), allowing the fruit to cure for three days. Kiwifruit are seldom marketed immediately after harvest, and most fruit are sold only after curing in order to reduce microbial infection. The most common microbial infection is the *Botrytis* stem-end rot, which can lead to high losses of stored kiwifruit. Curing of the fruit can reduce the severity of the stem-end rot (Pennycook & Manning, 1992). Curing presumably allows the picking scar or wound to dry out, leading to a reduction of the infection by *Botrytis* (Banos, Long, & Ganesh, 1997; Beever, 1991; Ferguson, 1990b; Pennycook & Manning, 1992).

3.3 Sorting and grading of kiwifruit at the packhouse

After curing, fruit sorting was achieved by using the Compac kiwifruit sorting equipment (InVision 7000 Blemish Unit), equipped with 6-lane sizer machine (Figure 3.1 a). The Compac sorting equipment is capable of sorting fruit based on their geometrical attributes (length and diameter), shape, density and colour and, the size which is determined based on fruit weight. Grading of fruit occurs simultaneously with sorting and the fruit was graded using the Zespri Grade Standards (Appendix F). The fruit are graded into different classes and Class 1 fruit are used for export purpose. Once the sorting and grading of kiwifruit had been completed, the fruit were transferred on to roller belts for visual inspection which is part of the evaluation of quality. The fruit was assessed manually for softness (firmness), surface marks, cuts, punctures, bruises, insect damage, and fungal infection (Figure 3.1 b).

(a) (b)

Figure 3.1: (a) Compac InVision 7000 Blemish Unit installed at the Aongatete packhouse for sorting GREEN kiwifruits; (b) Visual inspection of kiwifruit at the packhouse before packaging.

3.4 Packaging of kiwifruits into trays

Class 1 kiwifruit was packed in single layers into cardboard trays (Carter Holt Harvey Packaging Ltd, New Zealand) (Appendix E). The trays were lined with PET (Polyethyleneteraphthalate) plastic pocket packs supplied by Alto Packing Ltd, New Zealand (Appendix E) for holding the fruit. The fruit was then packed into the cardboard trays and covered with HDPE (High Density Polyethylene) plastic liner supplied by Bay Trade Supplies, New Zealand (Appendix E) as shown in Figure 3.2.

Figure 3.2: Kiwifruits packed in single layer in cardboard tray and covered with HDPE liner.

The trays were then labelled with the details of the fruit: class, fruit count, variety, weight (grams), fruit size and grower line number, as shown in Figure 3.3. Each tray contained a designated number of fruit depending on the sizes of the fruit (sizes: 27, 30 or 33). The trays were stacked in pallets and stored in the packhouse cold storerooms until shipment.

Figure 3.3: Kiwifruit tray label

3.5 Transportation (export) of Green kiwifruit to India

The pallets of kiwifruit were transported from the packhouse to Tauranga Port, New Zealand in refrigerated (0-2°C) vehicles. The fruit pallets were then loaded into refrigerated (0-2°C) shipping containers according to the order placed by the importers/distributors from India. It took about three weeks to transport kiwifruit from New Zealand to the port of Mumbai in India through Singapore by sea.

3.6 Identification of importers/distributors in India

In order to study the logistics and supply chain in India, three importers/distributors of Zespri kiwifruit based in India were identified. The identified distributors were IG International, DJ Exports Pvt. Ltd. and Suri Agro Fresh Pvt. Ltd. The distribution centres for IG International and DJ Exports Pvt. Ltd. were based in Mumbai and Chennai (port cities) in India. The Suri Agro Fresh Pvt. Ltd. distribution centres were based in Mumbai and Delhi (inland city) in India. Both IG International and DJ Exports Pvt. Ltd. had distribution (supply) chains throughout the country (India). Meanwhile, Suri Agro Fresh Pvt. Ltd. had distribution (supply) chains only through the northern part of India.

3.7 Identification of supply chains through the distributors

Three supply chains were identified through the distributors. The first supply chain identified was through Suri Agro Fresh Pvt. Ltd., with the starting point at the Mumbai cool store (Savla Foods and Cold Storage Ltd), through Delhi wholesale market to Delhi retail market (vendor store) (Figure 3.4 & 3.5) .The second supply chain was through IG International within Mumbai city. Monitoring of this supply chain started at the Mumbai cool store (CJ Jain Cool Store), followed by the wholesale market (APMC market) and the Mumbai retail market (vendor store) (Figure 3.4 & 3.5). The third supply chain identified was through DJ Exports Pvt. Ltd. This supply chain started at the Mumbai cool store (Savla Foods and Cold Storage Ltd), then to Bangalore wholesale market (Safal Market, Bangalore) and retail market in Bangalore (Figure 3.4 & 3.5).

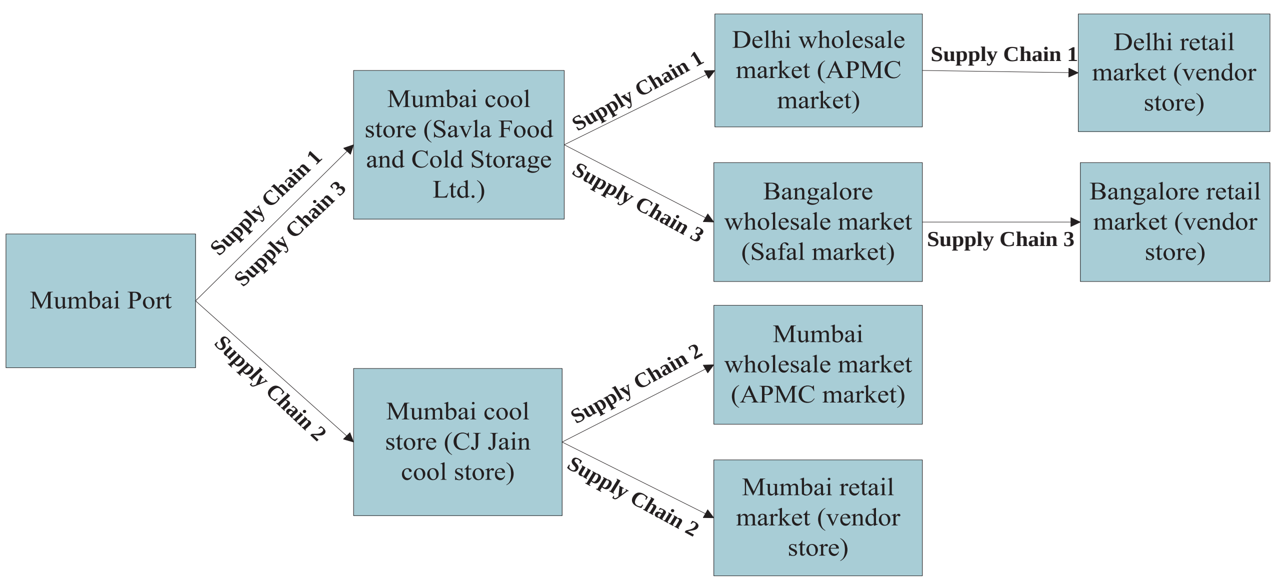


Figure 3.4: Flow diagram of the three identified supply chains

Identification of the supply chains were done in order to assess the quality of kiwifruits along these supply chains at each transfer points. '**On arrival**' and '**At departure**' assessment of fruit was conducted at each point along the cool chains.

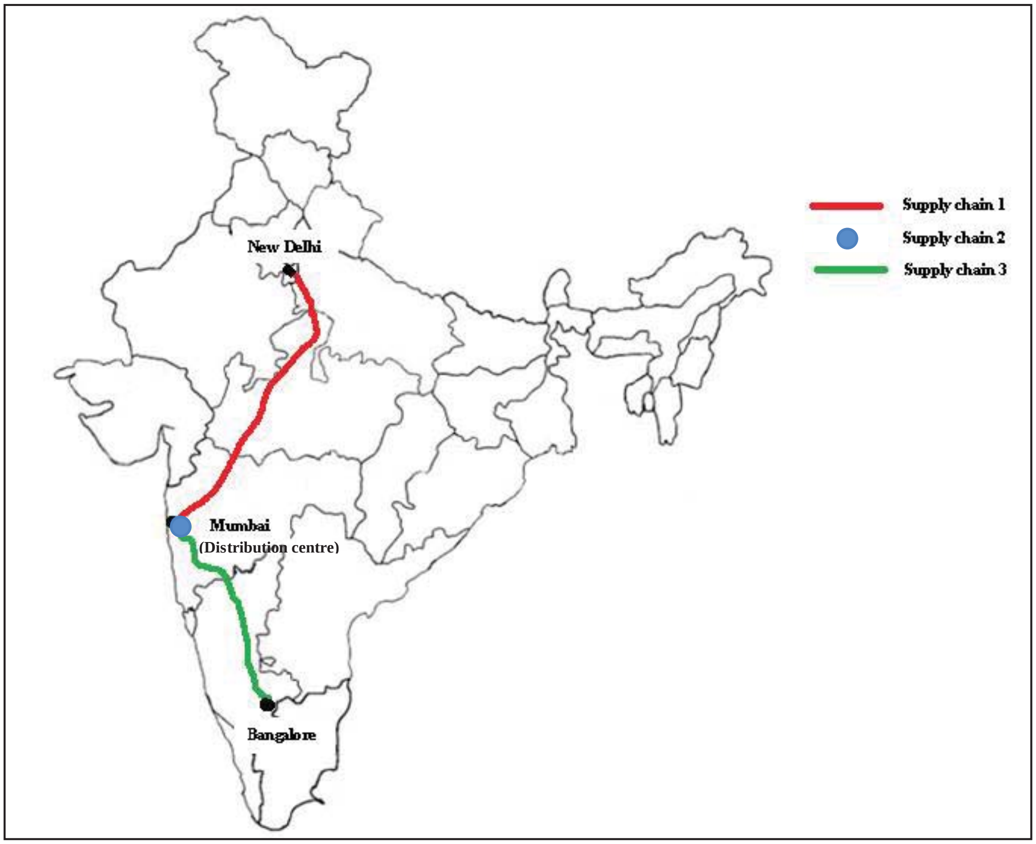


Figure 3.5: Map of India showing the routes of the three identified supply chains of kiwifruit

3.8 Evaluation of identified supply chains

Supply Chain 1

Monitoring of the cool chain through Suri Agro Fresh Ltd., identified as supply chain 1 commenced with the delivery of kiwifruit to the cool store (Savla Foods and Cold Storage Ltd) in Mumbai. The container (**MYRU 4504840**), which arrived at the port on 30th June 2011 was cleared by the Indian customs and transported to Savla Foods and Cold Storage Pvt. Ltd on 9th July 2011. The container was opened and the trays of kiwifruits were transferred to cold storage (3.2°C) (Figure 3.6 a). Three grower lines (71714, 74047 and 50657) were identified among this lot of kiwifruit. Eighteen trays were randomly selected, six trays from each grower line and then labelled. Three data loggers were placed randomly in the selected trays to record the temperature during storage and transportation along the supply chain.

Among the labelled trays, three trays of fruit (one from each grower line) were analysed for 'On arrival' fruit quality. The remaining fifteen trays were stored for three days at the cool store until further transfer along the supply chain. After three days of storage at the cool store, 'At departure' fruit quality of the three grower lines was analysed by measuring flesh firmness (FF), core temperature (CT) and soluble solids content (SSC). Twelve labelled trays were then transported to Delhi in a refrigerated (2.8°C) truck together with apples and oranges. The truck reached Delhi wholesale market after four days and was unloaded on the same day. After unloading, 'On arrival' quality of kiwifruits belonging to the three grower lines was determined by measuring the flesh firmness, core temperature and total solids content. The remaining (nine) trays were stored at the wholesale market cool storeroom for a further two days. Three trays were assessed for 'At departure' quality at the end of the storage period at the wholesale market.

The remaining six trays were then transported to the vendor store in a non-refrigerated vehicle. 'On arrival' fruit quality of the three grower lines was assessed and three trays were then stored at ambient temperature (35±2°C) until purchased by the customers (Figure 3.6 b). Quality of the fruit was tested again, just before the fruits were sold to customers. The data logging was stopped and the temperature readings were retrieved. Figure 3.7 shows the flowchart of the transfer, storage and assessment (sampling) points of the kiwifruit along Supply Chain 1.

(a) (b)

Figure 3.6: (a) Kiwifruit trays stored at Savla Foods and Cold Storage Pvt. Ltd., (b) Kiwifruit displayed at Delhi retail market for purchase.

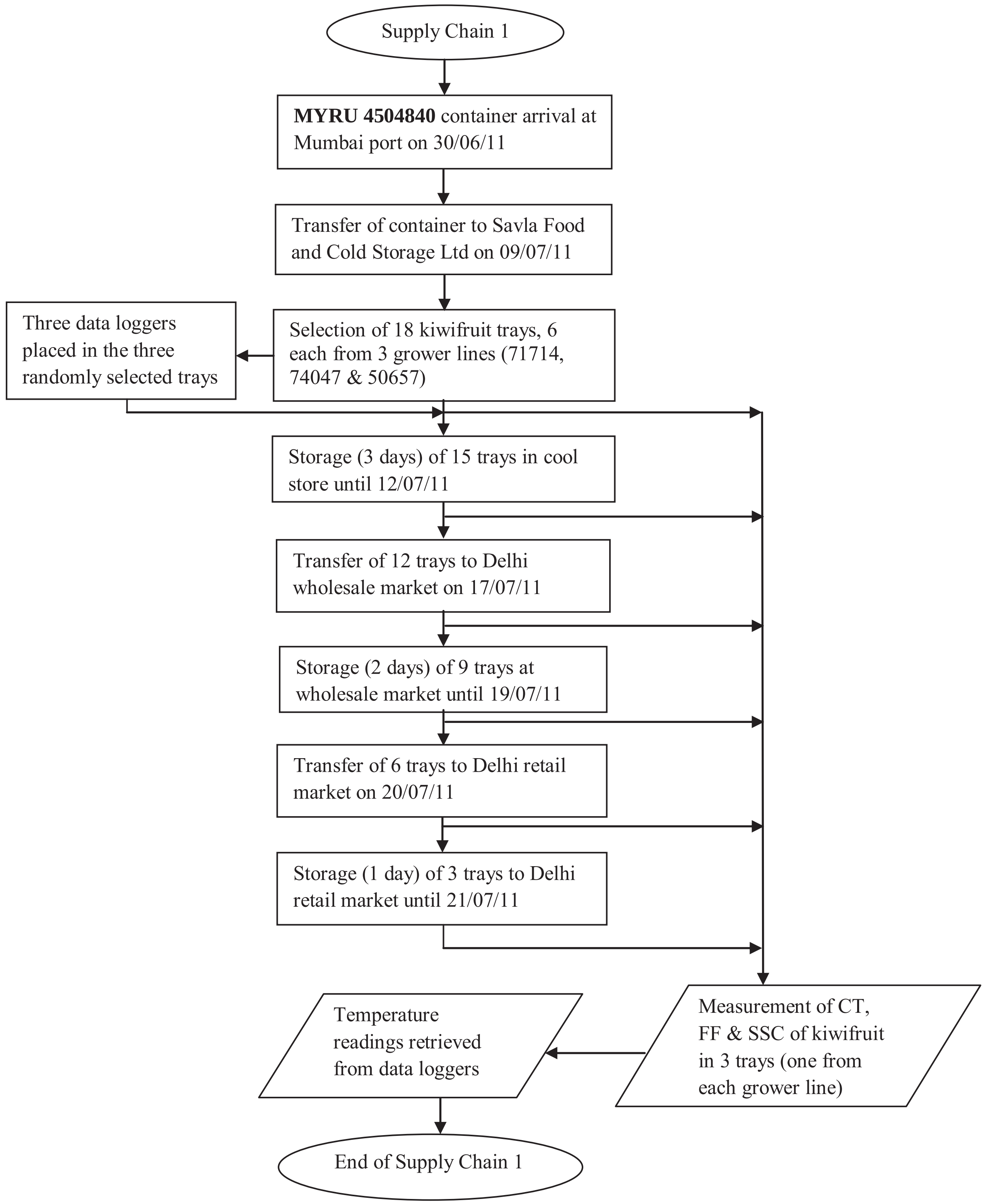


Figure 3.7: Movement of kiwifruit and measurement of core temperature (CT), flesh firmness (FF) and soluble solids content (SSC) of kiwifruit along Supply Chain 1.

Supply Chain 2

The kiwifruit container (**MYRU 4514962**) ordered by IG International arrived at Mumbai port on 23rd July 2011 and was cleared by the Indian customs on 27th July 2011. The container was transported to the cool store (CJ Jain Cool Store) on the same day. Once the container was opened, eighteen kiwifruit trays (six trays from each grower line) were randomly selected. The identified grower lines for this supply chain were 27824, 41503 and 90603. The selected eighteen trays were labelled and three data loggers were placed randomly in the trays for temperature recording.

Three trays of fruit, one from each grower line were analysed for the 'On arrival' quality of kiwifruit at the cool store. The remaining fifteen trays were stored at CJ Jain Cool Store for three days (Figure 3.8 a). Quality of three fruit trays (one from each grower line) was analysed to determine the 'At departure' fruit quality at the cool store. Of the remaining twelve trays, six trays were transported to the wholesale market (APMC market) and six trays to the retail market/vendor store. Three trays were assessed for 'On arrival' quality at the wholesale market and the remaining trays were stored for a day at the market storeroom. 'On departure' quality was determined by testing fruit from the remaining three trays after one day.

'On arrival' quality of kiwifruits delivered to the retail market was determined by measuring the core temperature, flesh firmness and total solids content. Kiwifruits were displayed at the market for sale (Figure 3.8 b) while the labelled trays containing kiwifruits were stored at ambient temperature for four days. The fruit quality was assessed just before the kiwifruits were sold to customers. Data logging was stopped and the data were retrieved from the temperature loggers at the end of this supply chain. Figure 39 shows the flowchart of the transfer, storage and assessment (sampling) points of kiwifruit along Supply Chain 2.

(a) (b)

Figure 3.8: (a) Trays of green kiwifruit stored at CJ Jain cool store, (b) Kiwifruit displayed at Mumbai retail market/vendor store.

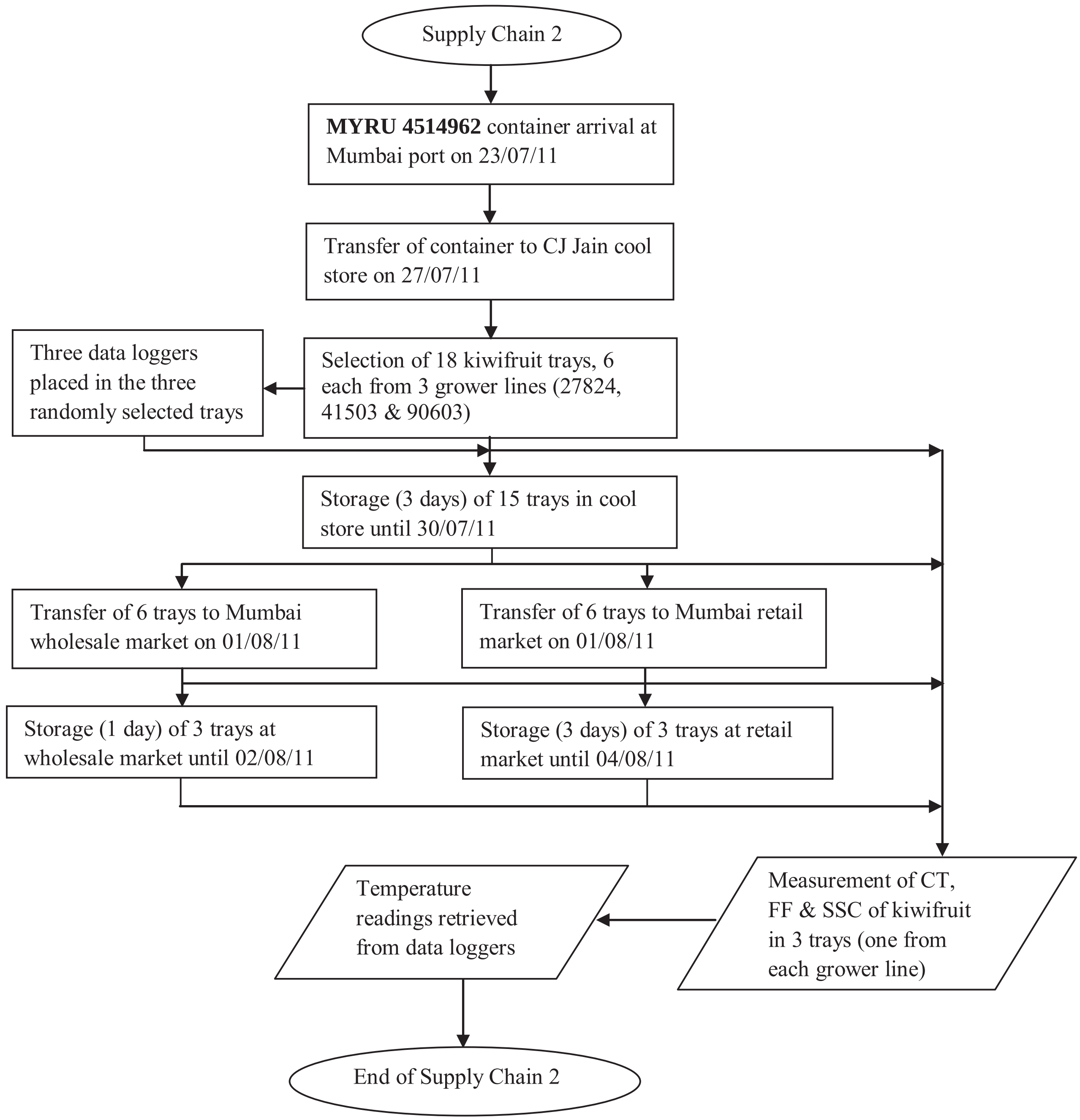


Figure 3.9: Movement of kiwifruit and measurement of core temperature (CT), flesh firmness (FF) and soluble solids content (SSC) of kiwifruit along Supply Chain 2.

Supply Chain 3

The third supply chain through DJ Exports Pvt. Ltd. began on 4th August 2011. The container **MYRU 450712** that arrived at Mumbai port on 11th June 2011 was transported to the Savla Foods and Cold Storage Ltd. on 29th July 2011 after clearance by Indian Customs. The container was unloaded on the 5th day after arrival, due to the unavailability of storage space. Eighteen kiwifruit trays, six trays each from the grower lines 19583, 10122 and 13143 were selected and labelled. 'On arrival' fruit quality was determined by assessing three trays of kiwifruit, one from each grower line, while the remaining fifteen trays were kept at the cool store (Figure 3.10 a). Three trays were assessed for 'At departure' fruit quality the next day before transportation of the fruits to Bangalore.

Twelve labelled trays were loaded in a refrigerated truck together with apples, oranges and cherries and transported to the wholesale market (Safal Market) in Bangalore in two days. Three kiwifruit trays were analyzed for 'On arrival' quality at the wholesale market (Safal Market). The remaining trays were stored at the market cool store for one day before it was collected by a vendor. The fruits belonging to grower lines 19583, 10122 and 13143 were analysed just before departure of kiwifruit trays to the next transfer point (vendor store) in the supply chain. The trays were then transported to the vendor store in a non-refrigerated vehicle and 'On arrival' fruit quality of the three grower lines was assessed. The remaining three trays were stored at ambient temperature for five days. Figure 3.10 b shows the display of kiwifruits for sale at the vendor store. At the end of this storage period, the last three kiwifruit trays were tested for fruit quality. Data logging was stopped and the temperature readings along the Supply Chain 3 were retrieved. Figure 3.11 shows the flowchart of the transfer, storage and assessment (sampling) points of kiwifruit along Supply Chain 3.

(a) (b)

Figure 3.10: (a) Labelled kiwifruit trays stored at the wholesale market (Safal Market), Bangalore; (b) Kiwifruit displayed at the vendor store in Bangalore.

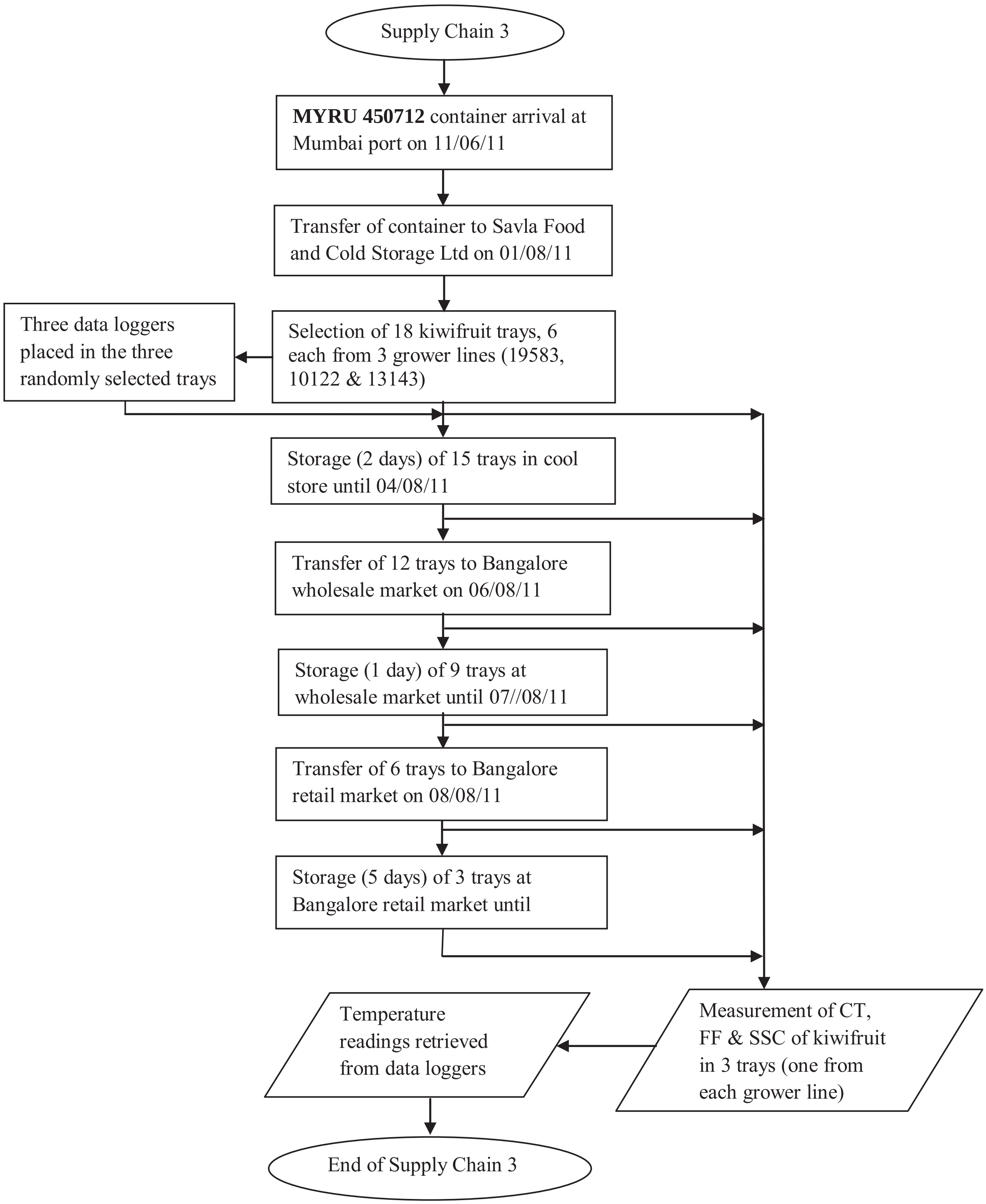


Figure 3.11: Movement of kiwifruit and measurement of core temperature (CT), flesh firmness (FF) and soluble solids content (SSC) of kiwifruit along Supply Chain 3.

3.9 Analysis of kiwifruit quality

3.9.1 Sampling and sample size

A sample size (n) of 20 kiwifruit was selected for this observational study. Twenty kiwifruits were randomly selected from each labelled tray (36 trays) and assessed for fruit quality at each analysis/sampling point. A total of 1080 (360 fruit per supply chain) were analysed along the three supply chains.

3.9.2 Measurement of core temperature

Core temperature of each kiwifruit was measured at every analysis/sampling point. A core thermometer was used for the measurement of fruit temperature (Testo 106, Testo Incorporated, USA). This instrument consisted of a thin measuring tip/probe (Type NTC-Negative Temperature Coefficient) of 2.2 mm diameter (Ø) and 15 mm length (Figure 3.12). To measure the core temperature of the fruit, the probe was inserted to a depth of 50 mm at the stem-end of the fruit and the hold button was pressed to measure the core temperature. The core temperatures of all the 20 fruits from each grower line were recorded at every sampling point.

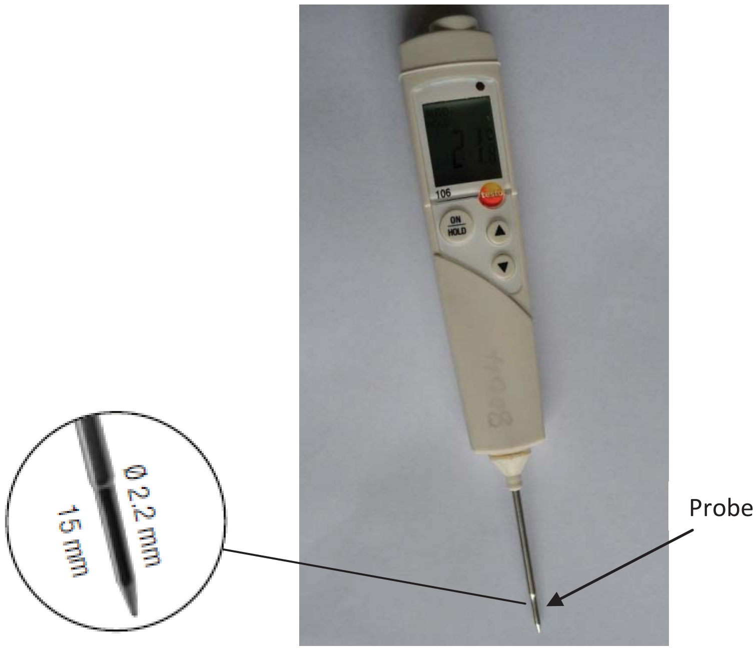


Figure 3.12: Testo 106 core thermometer (Testo Incorporated, USA) used for measuring the core temperature of kiwifruit.

3.9.3 Measurement of flesh firmness

The flesh firmness of kiwifruits was determined as described by McGlone and Kawano (1998), using a handheld penetrometer also known as fruit pressure tester (FT 011, Wilson, Italy). The penetrometer consisted of a plunger of 7.9 mm diameter (Ø) and pressure measurements are indicated in kilogram force (kgf) and pound force (lbf) (Figure 3.13). Each fruit was thinly (approximately 1.0 mm thickness) pared on two sides, adjacent to one another by using a cutter. The fruit was then placed on a flat surface and held firmly by the left hand to prevent any movement. The penetrometer was held between the thumb and the fore-finger of the right hand with the plunger placed against the pared region of the fruit. The plunger was then allowed to penetrate into the fruit flesh up to the notch (maximum depth of 8 mm) at the rate of 4 mm s^{-1} (2 s to maximum depth). The firmness of the fruit was measured on both pared sides and averaged to give the flesh firmness of the fruit.

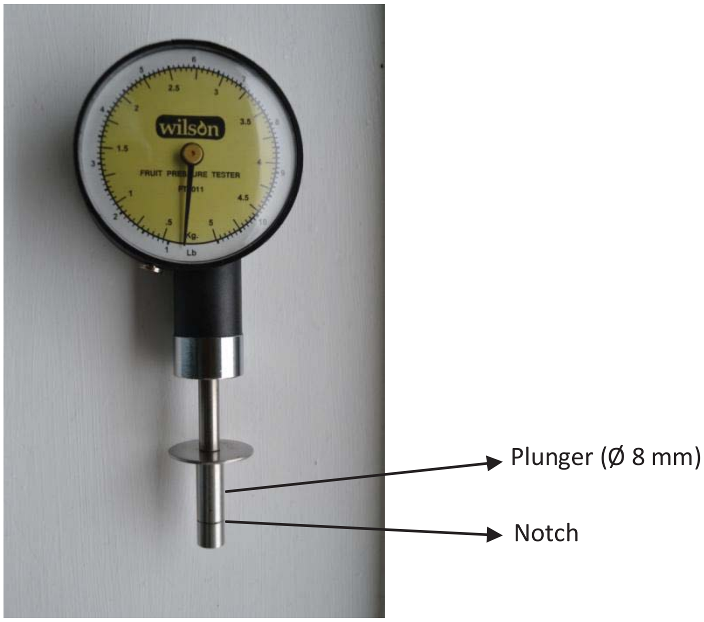


Figure 3.13: Fruit pressure tester/penetrometer (FT 011, Wilson, Italy) used to determine the flesh firmness of kiwifruit.

3.9.4 Measurement of soluble solids content

All the kiwifruits were analysed for the soluble solids content (SSC) as described by McGlone and Kawano (1998), McGlone (2002) and Burdon (2007), using a digital refractometer (Figure 3.14) also known as a portable Brix Meter (RA-250WE, KEM, Japan). The refractometer was calibrated to zero using distilled water at the beginning of day's analyses and after analyses of 20 fruits. The kiwifruits were cut into two pieces equatorially by using a knife. Juice from the stem-end piece of the fruit was squeezed onto the prism of the refractometer until fully covered and 'Measure' key was pressed immediately to record the percentage of Brix in the fruit.

Figure 3.14: Refractometer (RA-250WE, KEM, Japan) calibrated to ‘zero’ before measurement of SSC in kiwifruit

3.9.5 Temperature monitoring

The software known as ‘eTemperature’ (©2004-2005, OnSolution Pty Ltd) was used for monitoring the temperature along the supply chains in this study. Data loggers from iButton® (DS21, Maxim Innovation, USA) were used to record the temperature fluctuations during the storage and transportation of kiwifruit trays. The data loggers were connected to the ‘eTemperature’ software through iButton® reader (DS1402D-DR8+, Maxim Innovation, USA). The data loggers were set at logging mode just before placing them in the kiwifruit trays. The interval of recording time was set to 10 minutes. At the beginning of each supply chain, three data loggers were be placed randomly in the selected kiwifruit trays and allowed to record temperatures until the end of each supply chain. The data loggers were then removed, stopped and temperature readings from each logger were retrieved.

4.0 STATISTICAL ANALYSIS AND MODELING

4.1 Statistical analysis

Graphs showing the data of flesh firmness and soluble solids content (Brix) of kiwifruit along each supply chain were generated using Microsoft® Excel 2007 (Microsoft®, USA). The data were checked for normality using Kolmogorov-Smirnov and Shapiro-Wilk test of the PASW Statistics® 18.0 (SPSS Inc, USA, 2009). The Student (Paired) T-test was then conducted to determine any significant (P<0.05) differences in flesh firmness and SSC of the fruit from each grower line along the supply chains. Multiple comparisons were conducted by one-way analysis of variance (ANOVA) (PASW Statistics® 18.0) to determine any significant (P<0.05) differences in flesh firmness and SSC between the grower lines within each supply chain.

4.2 Modelling

4.2.1 Model fit for firmness loss

The flesh firmness data collected along each supply chain were fitted with three firmness loss models (Simple Exponential, Boltzmann and Inverse Exponential Polynomial) (Jordan & Loeffen, 2009), using CurveExpert Professional® 1.3.0 (©2011, Daniel G. Hyams). The models were chosen as they are monotonic, that is, they generate slopes that decrease from left to right, which is consistent with the observation made in this study; the fruit becomes softer during storage. The firmness loss models contain few parameters that characterize the dataset (Benge et al., 2000).

The equations of the chosen models were as follows:

Simple Exponential

$$FF = A_0 + A_1 e^{-\lambda t} \tag{1}$$

Boltzmann

$$FF = A_0 + \frac{\Delta A}{1 + e^{(t - t_k)/\lambda}} \tag{2}$$

Inverse Exponential Polynomial

$$FF = \frac{\delta}{1 + e^{(\beta_0 + \beta_1 t + \beta_2 t^2 + \beta_3 t^3)}} \tag{3}$$

In equation 1, *FF* represents flesh firmness, A_0 represents the lower asymptotic value, A_1 represents the drop in the firmness from the initial value to the lower asymptote, λ represents the relative rate of decline with time and t is the number of days in storage. In equation 2, *FF* is the flesh firmness, A_0 represents the lower asymptote, ΔA represents the difference between the upper and lower asymptote, t is the time after harvest (days), t_k is the time taken (days) for the firmness to decrease by $\Delta A/2$ from the upper asymptote, λ is the relative rate of decline with time. Meanwhile, in equation 3, *FF* means the flesh firmness, δ is the scale parameter, β represents the horizontal shift parameter and t represents the number of days in storage.

4.2.2 Model fit for storage potential

Flesh firmness and core temperatures of fruit measured along each supply chain were fitted with non-linear regression models and suitable models characterizing the data were selected. The three models chosen were the Reciprocal, Power and Reciprocal Quadratic as shown in equations 4, 5 and 6 respectively.

Reciprocal

$$FF = \frac{1}{a + bT} \quad (4)$$

Power

$$FF = a \times b^T \quad (5)$$

Reciprocal Quadratic

$$FF = \frac{1}{a + bT + cT^2} \quad (6)$$

In equation 4, *FF* is the flesh firmness and *T* is the core temperature of the fruit, *a* is the intercept of the Reciprocal model where *a* becomes 1/*FF* as *T* approaches zero, and *b* is the slope of the Reciprocal model where it becomes the reciprocal of maximum flesh firmness (1/*FF*) as *T* approaches the maximum. The Reciprocal model describes an asymptotic response of flesh firmness to core temperature of the fruit.

In equation 5, *FF* is the flesh firmness of kiwifruit, *T* is the core temperature of the fruit, *a* is the coefficient of the Power model where it becomes the maximum flesh firmness (*FF*) as the core temperature (*T*) approaches zero, and *b* is the coefficient of competition.

The Reciprocal Quadratic model is an expansion of the Reciprocal model (Westcott & Callan, 1990) and it describes the parabolic response of flesh firmness to core temperature of the fruit. In equation 6, FF represents the flesh firmness, T represents the core temperature of the fruit, a is the constant term which determines the shape of the curve, b is the linear coefficient of the Reciprocal Quadratic model and c represents the quadratic coefficient of the Reciprocal Quadratic model. Similar models were used in another study conducted by Westcott et. al (1990), where modelling of plant population and rectangularity effects on broccoli head weights and yield was investigated (Westcott & Callan, 1990).

4.2.3 Determination of best model fit

Determination of the best model fit for the flesh firmness data along each supply chain was done by conducting the Akaike Information Criteria (AIC) test (Anderson, Burnham, & White, 1994). The AIC is the measure of the relative goodness of fit of a statistical model. Given a dataset, several models can be ranked according to their AIC values (Anderson et al., 1994). In general, the AIC value is calculated by using equation 7.

$$AIC = 2k - 2\ln(L) \qquad (7)$$

In equation 7, k represents the number of parameters and L represents the maximized value of the likelihood function for the estimated model. Among the various models for a given dataset, the model with the lowest AIC value and standard error being closet to 'zero' is the preferred model (Burnham & Anderson, 2002; Conner & Seborg, 2004).

When k is large relative to the sample size n (which includes when the size of n is small for any given value of k), a small-sample (second-order bias correction) version called AIC_c is calculated by equation 8:

$$AIC_c = -2\log(L) + 2k + \frac{2k(k+1)}{n-k-1} \qquad (8)$$

The AIC_c value is used to compare the models regardless of what the sample size is, since the AIC_c converges to the AIC, as n gets larger in practice (Burnham & Anderson, 2002; Conner & Seborg, 2004).

The individual AIC values are not interpretable as they contain arbitrary constants and are much affected by the sample size. It is therefore imperative to rescale AIC or AIC_c to Δ_i using equation 9.

$$\Delta_i = AIC_i - AIC_{min} \qquad (9)$$

In equation 9, AIC_{min} is the minimum of R (number of models) different AIC_i values (i.e., the minimum is at $i = min$). This transformation forces the best model to have $\Delta = 0$, while the rest of the models attain positive values. The larger the Δ_i value, less probable is the fitted model i as being the best model. The rule of thumb which is often used for assessing the relative merits of models in the set are: Models having $\Delta_i \leq 2$ have substantial support (evidence), those in which $3 \leq \Delta_i \leq 9$ have considerably less support, and models having $\Delta_i >$ 10 have no essential support. For a given dataset, the simple exponential transformation of $(-\Delta_i/2)$, where i = 1,2……R, provides the likelihood of the model (Burnham & Anderson, 2002; Conner & Seborg, 2004).

The Akaike's weight (w_i) provides the measure of strength of evidence of each model relative to the other model (Burnham & Anderson, 2002) and is calculated by using equation 10:

$$w_i = \frac{e^{-0.5\,\Delta_i}}{1 + e^{-0.5\,\Delta_i}} \qquad (10)$$

The Akaike's weight indicates the probability that the model is the best among the whole set of selected models (Burnham & Anderson, 2002).

5.0 RESULTS

5.1 Assessment of data collected along each supply chain

5.1.1 Supply Chain 1

A. Effect of time and temperature on flesh firmness of kiwifruit

The mean initial flesh firmness of the fruit belonging to Grower line 1 (71714) was 2.049±0.22 kgf. There was no significant ($P>0.05$) reduction in the firmness after three days of storage at the Mumbai cool store (Savla Food and Cold Storage Ltd). The flesh firmness reduced significantly ($P<0.05$) to 0.897±0.10 kgf, with values reaching below recommended export minimum firmness (1 kgf) during transportation of the fruit from Mumbai to Delhi wholesale market. During fruit storage at the wholesale market, loss of flesh firmness was significant ($P<0.05$), with values reaching as low as 0.684±0.14 kgf. The reduction in firmness was significant when the fruit was delivered at the wholesale market. After 12 days (at the end of the supply chain), the mean flesh firmness was 0.543±0.05 kgf (Figure 5.1). Temperature fluctuations (between 2.8°C and 19.3°C) during storage and transportation of fruit could be responsible for significant ($P<0.05$) reduction in flesh firmness (Figure 5.2).

A similar pattern of firmness loss was observed in samples of fruit belonging to Grower line 2 (74047). The average initial flesh firmness of the fruit was 2.306±0.40 kgf. As the storage temperature increased from 2.8 °C to 4.9°C during storage at Mumbai cool store, the mean flesh firmness reduced to 2.007±0.29 kgf. There was no significant ($P>0.05$) reduction during storage at Mumbai cool store. While the fruit was being transported to Delhi wholesale market, the storage temperature increased to 10.4°C, thereby causing a significant ($P<0.05$) reduction in firmness. The flesh firmness reduced to 1.242±0.22 kgf when the fruit reached the wholesale market. During storage at the wholesale market, further reduction in firmness was observed. The flesh firmness was below the recommended minimum export firmness (1 kgf) by the time the fruit reached the Delhi retail market. At the time of purchase, the mean fruit firmness was 0.671±0.11 kgf and hence, a significant ($P<0.05$) reduction in the firmness was observed at the end of 12 days (Figure 5.1) with temperature as high as 19.3°C (Figure 5.2).

Fruit belonging to Grower line 3 (50657) had the highest firmness value among all the three grower lines with mean initial flesh firmness of 2.761±0.49 kgf. The reduction in flesh firmness was not significant (*P*>0.05) during the first three days of storage at the Savla Food and Cold Storage Ltd. A significant (*P*<0.05) reduction in firmness occurred during the transportation of the fruit to Delhi wholesale market. The flesh firmness was below 1 kgf (recommended minimum export firmness) (0.980±0.12 kgf) at the end of 10 days. The flesh firmness was 0.683±0.10 kgf at the end of the supply chain, which was a significant (*P*<0.05) reduction when compared to the initial flesh firmness (Figure 5.1) (Table 5.1). Temperature variation (between 2.8°C and 19.3°C) during storage and transportation of kiwifruit could be attributed to the significant reduction in flesh firmness (Figure 5.2).

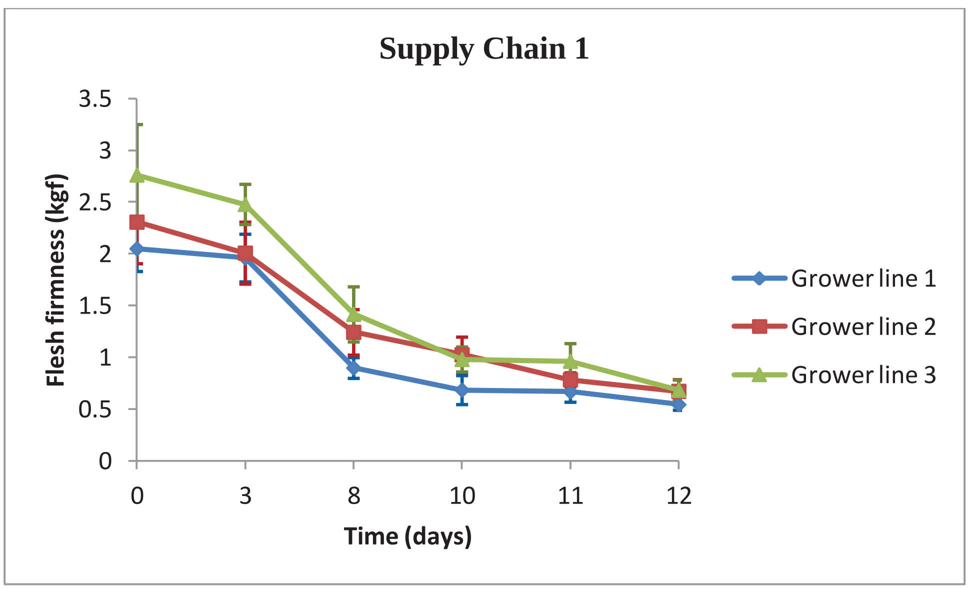


Figure 5.1: Effect of storage and transportation on flesh firmness (kgf) of kiwifruit belonging to the three grower lines along Supply Chain 1. Note: Time (days) represents the storage and transportation time of kiwifruit along Supply Chain 1; Error bars = Standard deviations for measurement of 20 fruit samples.

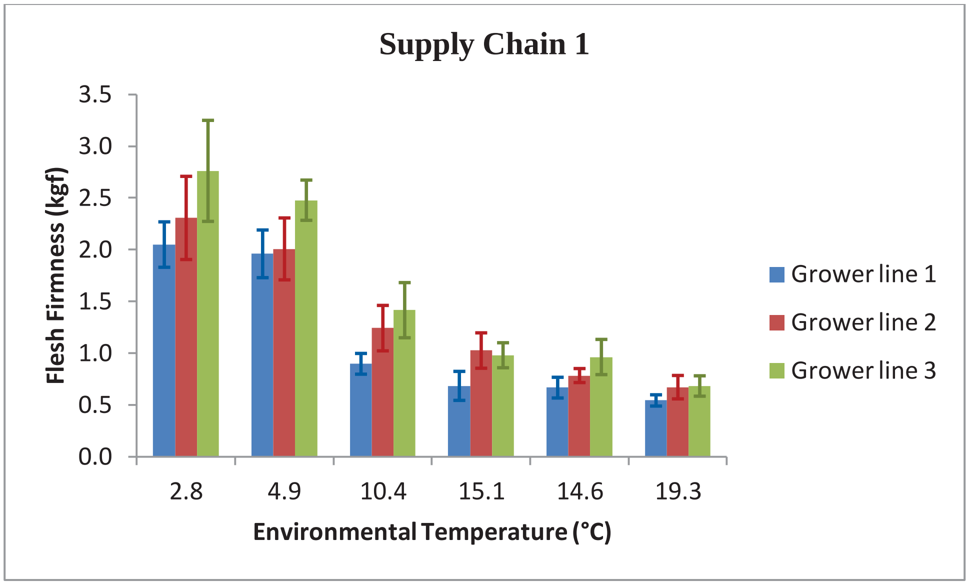


Figure 5.2: Effect of environmental temperature on flesh firmness (kgf) of kiwifruit belonging to the three grower lines along Supply Chain 1. Note: Error bars = Standard deviations for measurement of 20 fruit samples.

B. Effect of time and temperature on soluble solids content (Brix) of kiwifruit

A significant increase in soluble solids (SSC) content was observed in all grower lines along Supply Chain 1. The initial SSC (Brix) in fruit belonging to Grower line 1 was 10.7±0.62%, which increased significantly (P<0.05) to 11.4±0.84% by the end of 12 days. No significant (P>0.05) increase in SSC was observed in kiwifruit between each transfer point. Fruit belonging to Grower line 2 contained an average initial SSC of 10±0.78%, and at the end of the supply chain, the SSC was 10.7±0.78%. A significant (P<0.05) increase in SSC was also observed in Grower line 3, with SSC increasing from 10.2±0.62% to 11.5±0.75% (Figure 5.3) (Table 5.1).

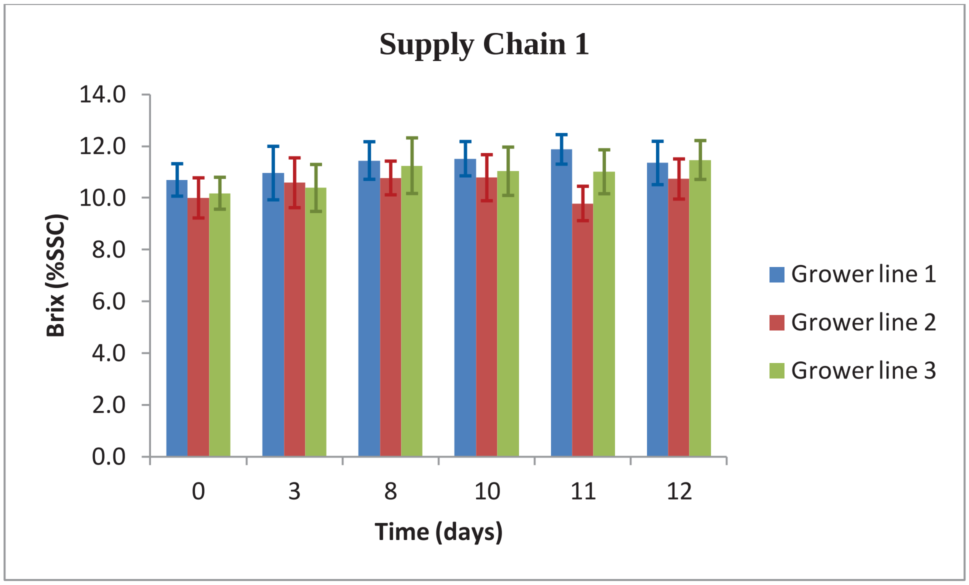


Figure 5.3: Changes in Brix (% SSC) of kiwifruit belonging to three grower lines along Supply Chain 1. Note: Time (days) represents the storage and transportation time of kiwifruit along Supply Chain 1; Error bars = Standard deviations for measurement of 20 fruit samples.

Storage temperature is one of the major factors influencing the quality of kiwifruit (Cotter & MacRae, 1991; Lallu, 1989; Thompson., 2003a, 2003b). As the environmental temperature increased, the soluble solids content of kiwifruit belonging to the three grower lines increased. Temperature varied between 2.8°C and 19.3°C during storage and transportation of kiwifruit along the supply chain. At the end of the supply chain, significant increase of Brix (% SSC) was observed in all the grower lines (Figure 5.4).

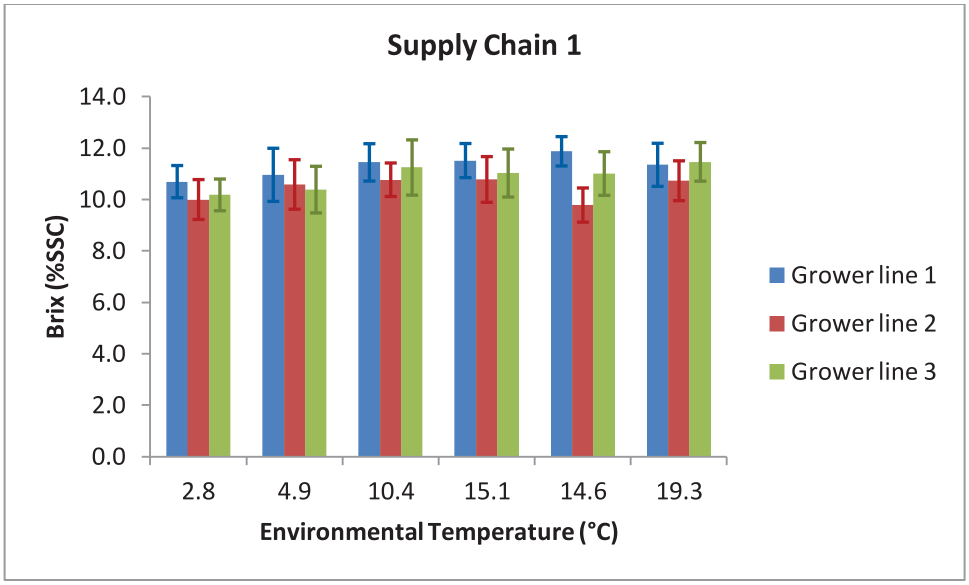


Figure 5.4: Effect of temperature variation (2.8-19.3°C) on Brix (%SSC) in three kiwifruit grower lines along Supply Chain 1. Note: Error bars = Standard deviations for measurement of 20 fruit samples.

Table 5.1: Summary of flesh firmness (kgf), Brix (%SSC) and core temperature (°C) of kiwifruit belonging to the three grower lines along Supply Chain 1

Grower line	Time (days)	Environmental temperature (°C)	Flesh firmness (kgf)	Brix (%SSC)	Core temperature (°C)
1	0	2.8	2.049±0.22	10.7±0.62	2.2±0.16
	3[a]	4.9	1.960±0.23	11.0±1.03	3.8±0.53
	8[b]	10.4	0.897±0.10	11.4±0.73	19.8±1.65
	10[a]	15.1	0.684±0.14	11.5±0.66	11.4±1.31
	11[b]	14.6	0.667±0.10	11.9±0.57	11.8±0.60
	12[a]	19.3	0.543±0.05	11.4±0.84	19.8±0.28
2	0	2.8	2.037±0.40	10.0±0.78	2.4±0.22
	3[a]	4.9	2.007±0.29	10.6±0.96	5.3±0.63
	8[b]	10.4	1.242±0.22	10.8±0.65	12.4±0.80
	10[a]	15.1	1.025±0.17	10.8±0.89	12.2±0.59
	11[b]	14.6	0.784±0.07	9.8±0.67	10.8±0.46
	12[a]	19.3	0.671±0.11	10.7±0.78	20.5±0.29
3	0	2.8	2.761±0.49	10.2±0.62	1.5±0.12
	3[a]	4.9	2.478±0.19	10.4±0.91	2.8±0.21
	8[b]	10.4	1.415±0.27	11.2±1.08	12.2±0.30
	10[a]	15.1	0.980±0.12	11.0±0.93	13.4±0.49
	11[b]	14.6	0.963±0.17	11.0±0.85	8.1±0.39
	12[a]	19.3	0.683±0.10	11.5±0.75	21.3±0.46

Note: Grower line 1 = 71714, Grower line 2 = 74047 & Grower line 3 = 50657. Time (days) represents storage and transportation time along Supply Chain 1; numbers with superscript 'a' indicate storage time and numbers with superscript 'b' indicate transportation time. In columns 4, 5 & 6, all values are means ± standard deviation (n=20 at every sampling point).

5.1.2 Supply Chain 2

A. Effect of time and temperature on flesh firmness of kiwifruit

An average initial flesh firmness of kiwifruit belonging to Grower line 1 (28724) was 2.625±0.19 kgf. A significant (P<0.05) reduction in firmness occurred during storage at the cool store (CJ Jain Cool Store) and flesh firmness was 2.319±0.12 kgf at the end of three days (Figure 5.5). The firmness of the fruit reduced further during the transportation to the Mumbai wholesale and retail markets (Table 5.2). The core temperature of the fruit transported to the retail market was 2.4±0.25°C while the core temperature of the fruit at the wholesale market was 14.6±2.03°C. Increase in temperature may be responsible for the reduction in flesh firmness and the fruit at the wholesale market was less firm compared to the fruit at the retail market (Figure 5.6). Significant (P<0.05) differences in firmness were observed between the fruit delivered to wholesale and retail markets.

During storage at the two markets (wholesale and retail), the temperatures of the fruit increased, as these fruits were not under refrigerated conditions. The core temperature of fruits at wholesale and retail markets were as high as 23.6±0.16°C and 27.2±0.23°C, respectively. Due to unrefrigerated storage and subsequent increase in core temperatures the firmness of the fruit decreased significantly (P<0.05). The average flesh firmness of the fruit at the wholesale market was 2.000±0.15 kgf at the end of 5 days. While the flesh firmness of the fruit at the retail market reduced further, and at the end of the supply chain (7 days) the average fruit firmness was 1.001±0.19 kgf (Figure 5.5) (Table 5.2).

An average initial firmness of fruit belonging to Grower line 2 (41503) was 2.930±0.48 kgf, which did not significantly (P>0.05) reduce during the first three days of storage at Mumbai cool store. A significant (P<0.05) reduction in the flesh firmness was observed when the fruits were transported to Mumbai markets (wholesale and retail). The flesh firmness of the fruit was 2.558±0.37 kgf when was delivered to the wholesale market (APMC market), while the firmness of the fruit was 2.443±0.10 kgf when it was delivered to the retail market. At the end of 5 days, the firmness of the fruit at the wholesale market was 2.153±0.20 kgf (Table 5.2). Firmness of the fruit at the retail market was 1.101±0.11 kgf at the end of 7 days

(Figure 5.5). Significant increase in the environmental temperature (3.3 to 26.4°C) could be the possible reason for firmness loss in kiwifruit (Figure 5.6).

The fruit from Grower line 3 (90603) were firmer when compared to the fruit belonging to the other two grower lines. The average initial flesh firmness of Grower line 3 fruit was 3.320±0.59 kgf. Reduction of firmness of fruit of Grower line 3 was similar to that of Grower line 1. Significant reduction in firmness of the fruit was observed throughout the supply chain. Due to the high variation in storage and transportation temperatures (3.3 to 26.4°C), significant ($P<0.05$) reductions in firmness were observed (Table 5.2). At the time of purchase, the average firmness of the fruit at the wholesale market was 2.219±0.20 kgf. Meanwhile, the firmness of the fruit at retail market was only 1.107±0.11 kgf (Figure 5.5 & 5.6) at the end of 7 days.

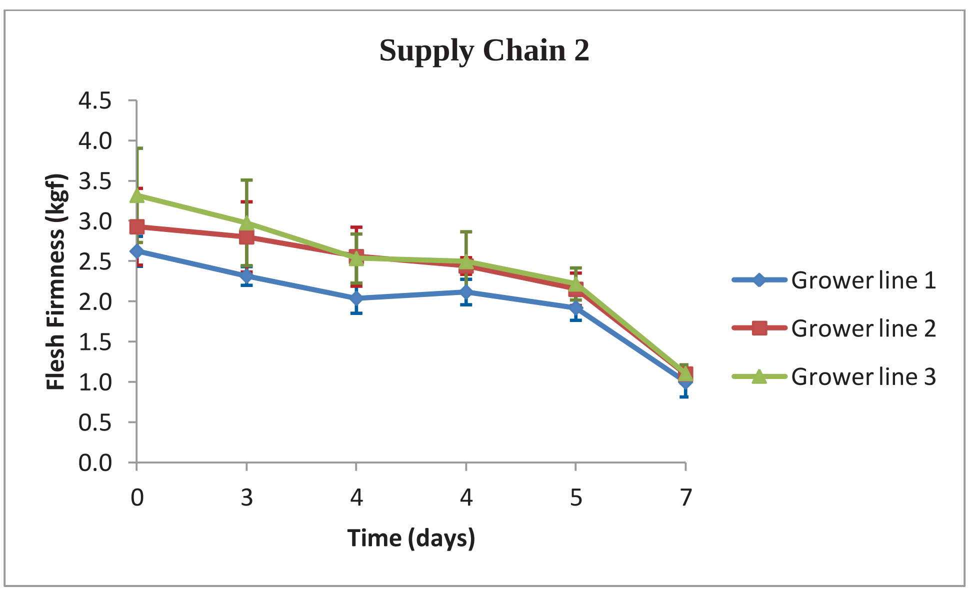


Figure 5.5: Effect of storage and transportation on flesh firmness (kgf) of kiwifruit belonging to the three grower lines along Supply Chain 2. Note: Time (days) represents the storage and transportation time of kiwifruit along Supply Chain 2; Error bars = Standard deviations for measurement of 20 fruit samples.

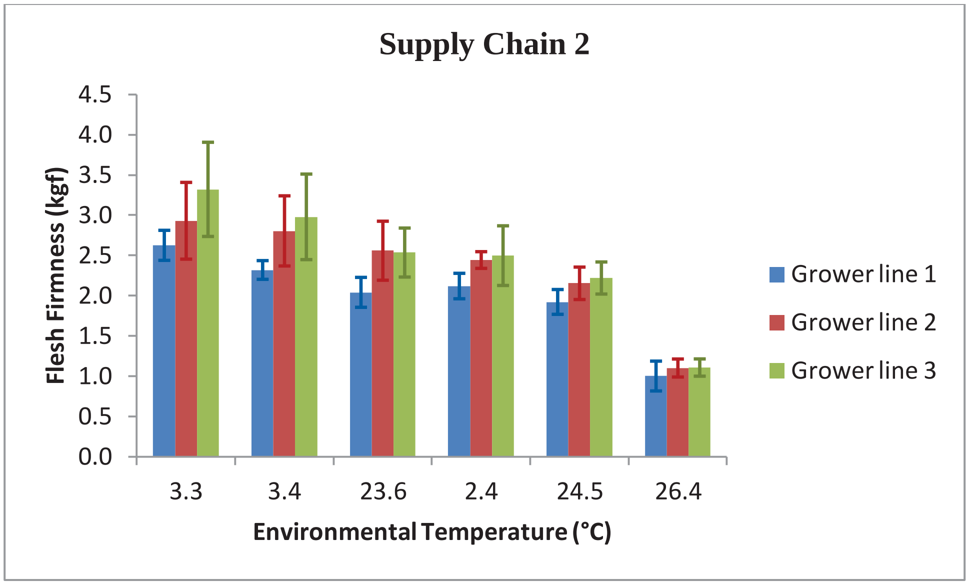


Figure 5.6: Effect of environmental temperature on flesh firmness (kgf) of kiwifruit belonging to the three grower lines along Supply Chain 2. Note: Error bars = Standard deviations for measurement of 20 fruit samples.

B. Effect of time and temperature on soluble solids content (Brix) of kiwifruit

Maturity and ripeness of kiwifruit is measured by determining the soluble solids content. The soluble solids content of all the fruit increased significantly along Supply Chain 2. The Brix values of fruit belonging to Grower line 1 increased significantly from 9.3±0.95% to 11.8±0.62%, while SSC of fruit from Grower line 2 increased from 10.7±1.06% to 11.6±0.89%. A significant ($P<0.05$) increase in SSC (9.0±0.59% to 10.5±0.57%) was also observed in Grower line 3 at the end of Supply Chain 2 (Figure 5.7).

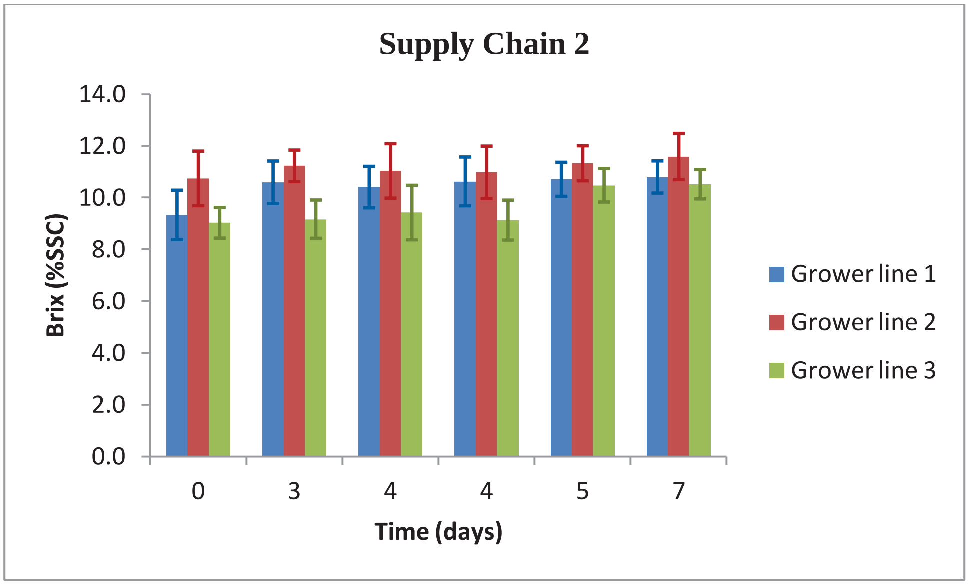


Figure 5.7: Changes in Brix (% SSC) of kiwifruit belonging to three grower lines along Supply Chain 2. Note: Time (days) represents the storage and transportation time of kiwifruit along Supply Chain 2; Error bars = Standard deviations for measurement of 20 fruit samples.

Soluble solids content of kiwifruit increase from the time of harvest and can reach up to 14% at the ripening stage. Storage temperature of kiwifruit plays an important role in the process of ripening. When the fruit is stored under non-refrigerated conditions, the ripening process is enhanced, thereby increasing the SSC of the fruit. This observation was made in all the grower lines along the Supply Chain 2. As the environmental temperature changed between 3.3°C and 26.4°C, the SSC of kiwifruit increased significantly ($P<0.05$) (Figure 5.8) (Table 5.2).

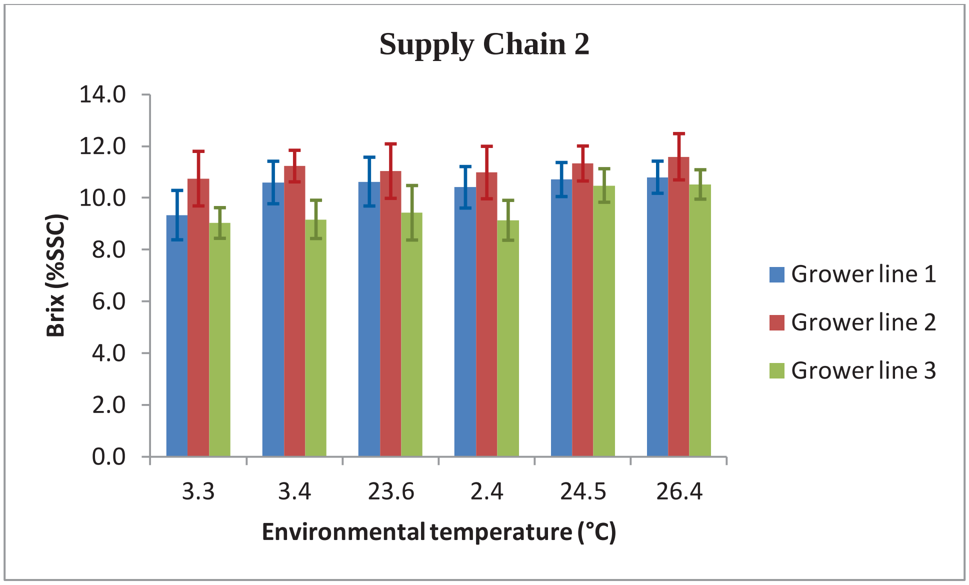


Figure 5.8: Effect of temperature variation (3.3-26.4°C) on Brix (%SSC) in three kiwifruit grower lines along Supply Chain 2. Note: Error bars = Standard deviations for measurement of 20 fruit samples.

Table 5.2: Summary of flesh firmness (kgf), Brix (%SSC) and core temperature (°C) of kiwifruit belonging to the three grower lines along Supply Chain 2

Grower line	Time (days)	Environmental temperature (°C)	Flesh firmness (kgf)	Brix (%SSC)	Core temperature (°C)
1	0	3.3	2.625±0.19	9.3±0.95	3.2±0.44
	3[a]	3.4	2.319±0.12	10.6±0.82	4.6±0.12
	*4[b]	2.4	2.119±0.16	10.4±0.80	2.4±0.25
	4[b]	23.6	2.041±0.19	10.6±0.94	14.6±2.03
	5[a]	24.5	2.000±0.15	10.7±0.66	23.6±0.16
	*7[a]	26.4	1.001±0.19	11.8±0.62	27.2±0.23
2	0	3.3	2.930±0.48	10.7±1.06	2.7±0.49
	3[a]	3.4	2.804±0.44	11.2±0.61	4.6±0.20
	*4[b]	2.4	2.558±0.37	11.0±1.05	1.6±0.21
	4[b]	23.6	2.443±0.10	11.0±1.01	21.3±0.91
	5[a]	24.5	2.153±0.20	11.3±0.68	23.9±0.13
	*7[a]	26.4	1.101±0.11	11.6±0.89	27.4±0.19
3	0	3.3	3.320±0.59	9.0±0.59	3.2±0.35
	3[a]	3.4	2.979±0.53	9.2±0.74	4.5±0.17
	*4[b]	2.4	2.536±0.30	9.4±1.05	1.8±0.38
	4[b]	23.6	2.497±0.37	9.1±0.77	15.6±1.79
	5[a]	24.5	2.219±0.20	10.5±0.65	23.6±0.20
	*7[a]	26.4	1.107±0.11	10.5±0.57	26.7±0.19

Note: Grower line 1 = 28724, Grower line 2 = 41503 & Grower line 3 = 90603. Time (days) represents storage and transportation time along Supply Chain 2; numbers with superscript 'a' indicate storage time and numbers with superscript 'b' indicate transportation time. *Numbers indicate sampling at the retail market. In columns 4, 5 & 6, all values are means ± standard deviation (n=20 at every sampling point).

5.1.3 Supply Chain 3

A. Effect of time and temperature on flesh firmness of kiwifruit

Data of fruit from three grower lines are presented in this section. Flesh firmness data collected along this supply chain indicated significant reduction in flesh firmness in fruit belonging to the three grower lines. Fruit softening in Grower line 1 (19583) was significant (P<0.05) during the first three days of storage. The average initial flesh firmness was 1.590±0.10 kgf, which reduced significantly along the supply chain and flesh firmness was 1.131±0.17 kgf by the time the fruit was delivered to the wholesale market (Safal market) in Bangalore. The firmness of the fruit was 1.066±0.13 kgf before being transported to the retail market. During transportation to Bangalore retail market, significant reduction in flesh firmness was observed and it was below the recommended minimum export firmness level of 1 kgf when the fruit was delivered at the retail market (Table 5.3). The flesh firmness of the fruit reduced further and was 0.592±0.08 kgf at the end of 12 days along Supply Chain 3 (Figure 5.9).

Grower line 2 (10122) fruit had no significant (P>0.05) reduction of flesh firmness during the first three days of storage at Mumbai cool store (Savla Food and Cold Storage Ltd). Flesh firmness of fruit decreased significantly (P<0.05) during the transportation of kiwifruit to Bangalore wholesale market. The average flesh firmness reduced to 1.457±0.13 kgf from the initial firmness of 1.650±0.17 kgf. Further reduction in firmness was observed along the supply chain. When the fruit was delivered to the retail market, the firmness had decreased to 1.433±0.13 kgf. At the end of storage at the retail market (before being sold to the customer), the firmness of the fruit was below the recommended minimum export firmness (1 kgf) (Table 5.3). The significant reduction in flesh firmness observed could be due to the variation in temperature (3.1-24.8°C) during storage and transportation along the supply chain (Figure 5.9 & 5.10).

The initial mean flesh firmness of fruit belonging to Grower line 3 (13143) was 1.504±0.15 kgf, which reduced significantly (P<0.05) to 1.330±0.16 kgf after 3 days of storage at the cool store. When the fruit was delivered to the wholesale market in Bangalore, average flesh firmness was 1.229±0.10 kgf. Further reduction in flesh firmness was observed when the storage temperature increased from 1.5°C to 7.1°C at the wholesale market. The firmness of the fruit was 1.019±0.09 kgf upon delivery to the retail market. During storage at the retail market, environmental temperature increased to 24.8°C thereby, reducing the flesh firmness (0.854±0.15 kgf) below the recommended minimum export firmness (1 kgf) (Figure 5.9). Significant reduction of firmness observed in Grower line 3 fruit could be due to temperature fluctuation (3.1-24.8°C) during storage and transportation (Figure 5.10) (Table 5.3).

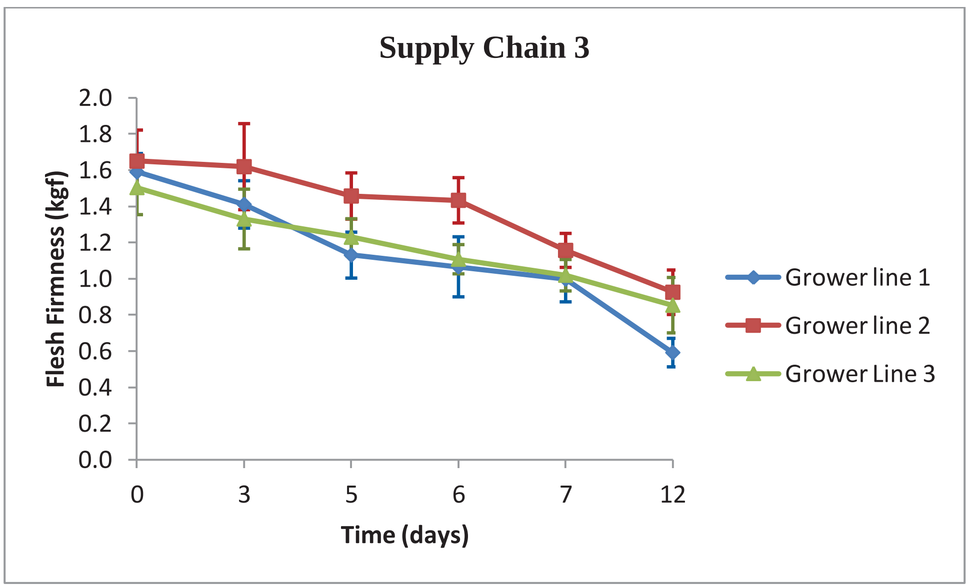


Figure 5.9: Effect of storage and transportation on flesh firmness (kgf) of kiwifruit belonging to the three grower lines along Supply Chain 3. Note: Time (days) represents the storage and transportation time of kiwifruit along Supply Chain 3; Error bars = Standard deviations for measurement of 20 fruit samples.

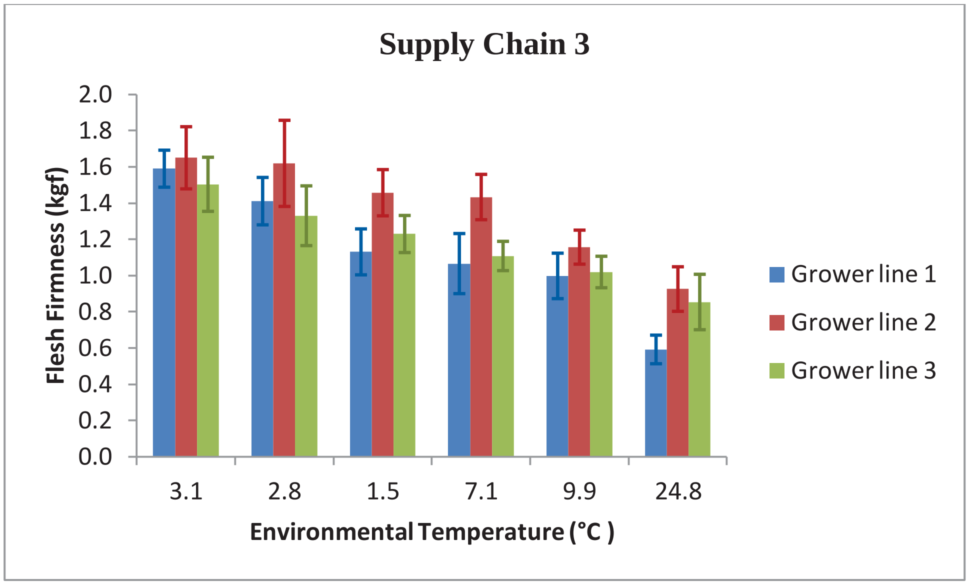


Figure 5.10: Effect of environmental temperature on flesh firmness (kgf) of kiwifruit belonging to the three grower lines along Supply Chain 3. Note: Error bars = Standard deviations for measurement of 20 fruit samples.

B. Effect of time and temperature on soluble solids content (Brix) of kiwifruit

The soluble solids content increases in kiwifruit after harvest and during ripening process. A significant ($P<0.05$) increase in Brix was observed in the three selected Grower lines of kiwifruit along the Supply Chain 3. However, the soluble solids content did not increase significantly ($P>0.05$) during the three days of storage at Mumbai cool store. After 5 days, the SSC of Grower line 1 fruit increased to 10.8±0.33% from the initial SSC of 10.2±1.08%. By the end of the supply chain (after 12 days), the SSC of fruit at the retail market was 11.9±0.52%. A similar pattern of change in SSC was observed in Grower line 2. The initial SSC (Brix) was 10.0±0.68%, which increased significantly ($P<0.05$) and the percentage of SSC was 12.0±0.36 at the end of the 12 days along the supply chain (Table 5.3). The initial SSC of fruit belonging to Grower line 3 was 10.6±0.47% SSC, and at the end of 12 days along Supply Chain 3 a significant increase to 12.0±0.48% was observed (Figure 5.11).

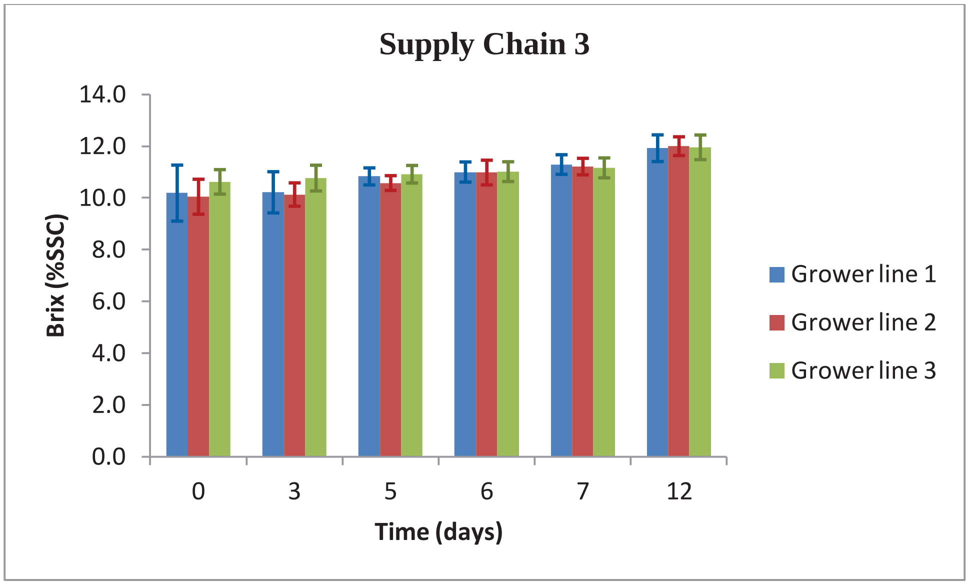


Figure 5.11: Changes in Brix (% SSC) of kiwifruit belonging to three grower lines along Supply Chain 3. Note: Time (days) represents the storage and transportation time of kiwifruit along Supply Chain 3; Error bars = Standard deviations for measurement of 20 fruit samples.

Temperature fluctuations and increase in environmental temperature were observed during storage and transportation of kiwifruit along Supply Chain 3. Temperature fluctuations could be one of the factors responsible for influencing the ripening process, thereby increasing the rate of metabolism. As the rate of metabolism increases in the fruit, starch was rapidly converted to simple sugars, thus increasing the soluble solids content of kiwifruit. The SSC of fruit in the three grower lines increased significantly ($P<0.05$) with increase in environmental temperature (Table 5.3) from 3.1°C to 24.8°C (Figure 5.12).

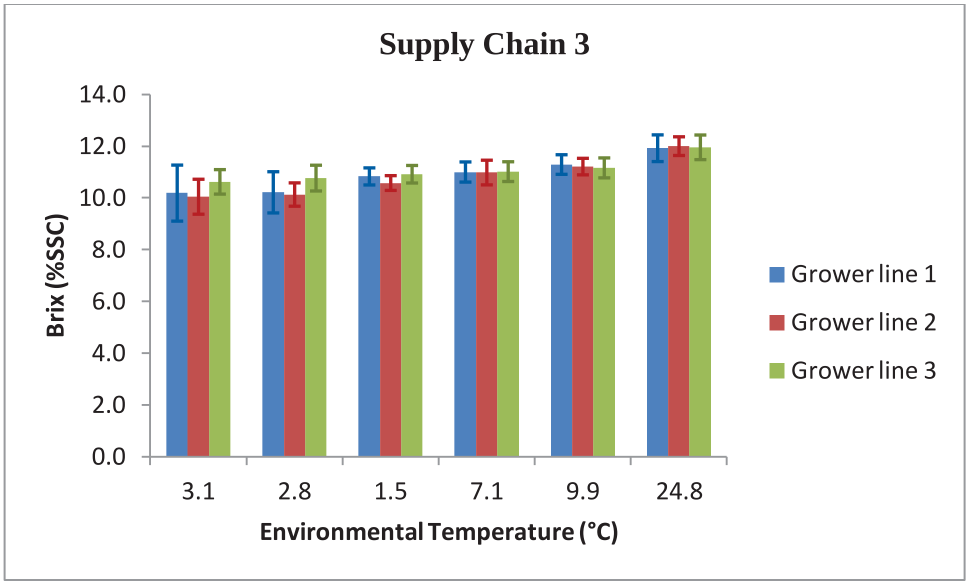


Figure 5.12: Effect of temperature variation (3.1-24.8°C) on Brix (%SSC) in three kiwifruit grower lines along Supply Chain 3. Note: Error bars = Standard deviations for measurement of 20 fruit samples.

Table 5.3: Summary of flesh firmness (kgf), Brix (%SSC) and core temperature (°C) of kiwifruit belonging to the three grower lines along Supply Chain 3

Grower line	Time (days)	Environmental temperature (°C)	Flesh firmness (kgf)	Brix (%SSC)	Core temperature (°C)
1	0	3.1	1.590±0.10	10.2±1.08	2.8±0.15
	3[a]	2.8	1.411±0.13	10.2±0.80	2.8±0.23
	5[b]	1.5	1.131±0.17	10.8±0.33	1.8±0.13
	6[a]	7.1	1.006±0.13	11.0±0.39	5.3±0.13
	7[b]	9.9	0.998±0.10	11.3±0.38	8.0±0.08
	12[a]	24.8	0.592±0.08	11.9±0.52	22.9±0.05
2	0	3.1	1.650±0.17	10.0±0.68	1.8±0.15
	3[a]	2.8	1.619±0.24	10.1±0.45	2.3±0.16
	5[b]	1.5	1.457±0.13	10.6±0.28	2.0±0.05
	6[a]	7.1	1.433±0.13	11.0±0.48	4.7±0.05
	7[b]	9.9	1.157±0.09	11.2±0.32	8.1±0.05
	12[a]	24.8	0.925±0.12	12.0±0.36	23.0±0.08
3	0	3.1	1.504±0.15	10.6±0.47	1.7±0.29
	3[a]	2.8	1.330±0.16	10.8±0.50	2.5±0.08
	5[b]	1.5	1.229±0.10	10.9±0.34	1.9±0.04
	6[a]	7.1	1.108±0.08	11.0±0.38	4.9±0.09
	7[b]	9.9	1.019±0.09	11.2±0.39	8.2±0.04
	12[a]	24.8	0.854±0.15	12.0±0.48	22.9±0.04

Note: Grower line 1 = 19583, Grower line 2 = 10122 & Grower line 3 = 13143. Time (days) represents storage and transportation time along Supply Chain 3; numbers with superscript 'a' indicate storage time and numbers with superscript 'b' indicate transportation time. In columns 4, 5 & 6, all values are means ± standard deviation (n=20 at every sampling point).

5.2 Model Fitting

5.2.1 Supply Chain 1

A. Firmness loss models

The three models reviewed in Chapter 2 were the Simple Exponential (SE) model, the Boltzmann model, and the Inverse Exponential Polynomial (IEP) model. The three models were fitted to the flesh firmness collected data during storage and transportation along Supply Chain 1 (Figure 5.13). Among the three firmness loss models, the best model for Supply Chain 1 dataset was the Simple Exponential model.

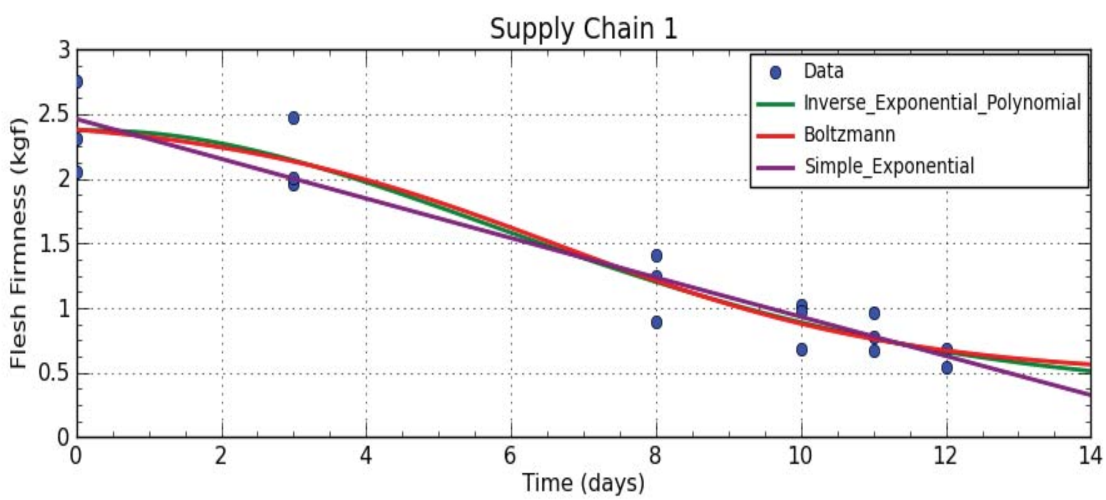


Figure 5.13: Three firmness loss models fitted to the flesh firmness data of kiwifruit obtained during storage and transportation along Supply Chain 1.

The likelihood that the SE model was better compared to the Boltzmann model was 59.56%, according to the Akaike Information Criteria (AIC). The probability of the Boltzmann model being a better model compared to the SE model was only 40.43%. The second order Akaike

Information Criterion (AIC_c) value is the measure of the relative goodness of fit of a statistical model. Among the various models for a given dataset, the model with the lowest AIC_c value and standard error being closest to 'zero' is the preferred model (Burnham & Anderson, 2002). The AIC_c value for the SE model (-51.43) was lower than that of the Boltzmann Model (-50.65) indicating the SE model to be a better model. The standard error value of the SE model (0.224) also indicated it to be a better model when compared to the Boltzmann model (0.229). The change in the AIC value (Δ_i) (0.7745) being < 2, suggested substantial evidence for the Boltzmann model to be the second best model (Figure 5.14).

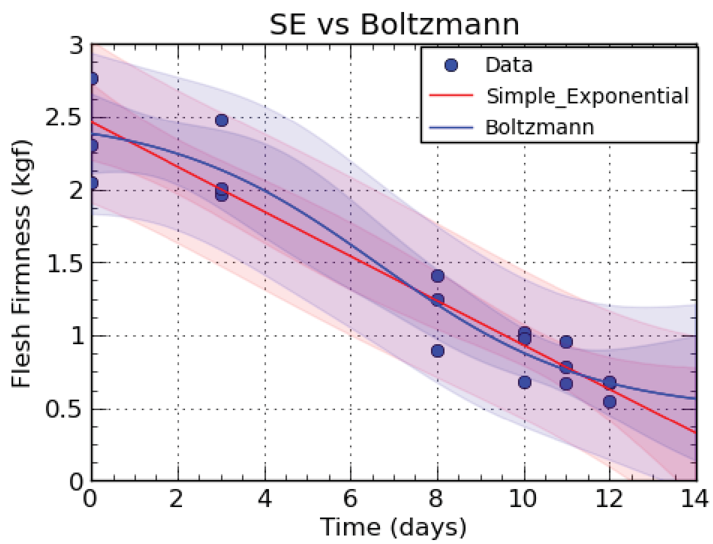


Figure 5.14: Comparison of the Simple Exponential and Boltzmann models fitted to the flesh firmness data collected during storage and transportation of kiwifruit along Supply Chain 1.

The probability of the IEP model being a better model compared to the SE model was only 1.88%. The likelihood that the SE model was a better model was 98.11%, with AIC_c value for the IEP model (-43.52) being higher than that of the SE model (-51.43). The standard error of the IEP model (0.241) was greater than that of the SE model (0.224), indicating the SE model to be the better model. The Δ_i value (7.9) was higher than 7, this indicated that the IEP model had considerably less support in characterizing the flesh firmness data, as compared to the SE model (Figure 5.15).

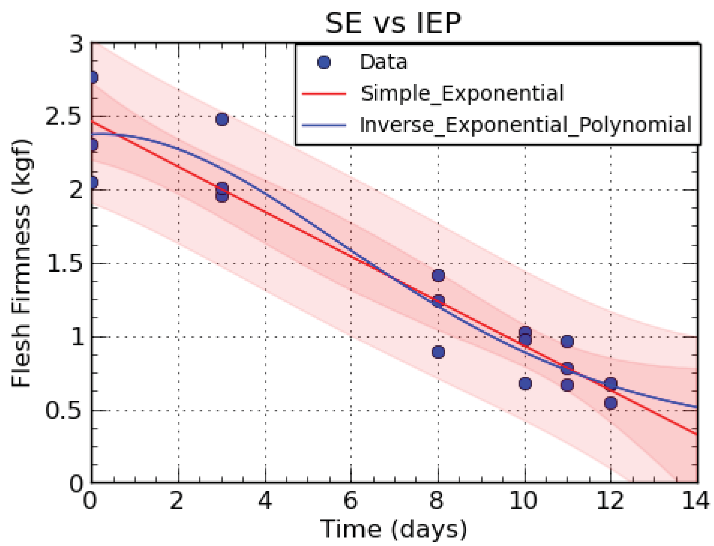


Figure 5.15: Comparison of the Simple Exponential and Inverse Exponential Polynomial models fitted to the flesh firmness data collected during storage and transportation of kiwifruit along Supply Chain 1.

Compared to the IEP model, the likelihood that the Boltzmann model was a better model was 97.25%. The probability of the IEP model being a better model compared to the Boltzmann model was only 2.75%. The AIC_c value for the IEP model (-43.53) was higher than that of the Boltzmann model (-50.65), indicating that the Boltzmann model was a better model. Calculation of standard error indicated that the Boltzmann model (0.229) was better than the IEP model (0.241). With Δ_i (7.13) being greater than 7, it indicated that the IEP model had considerably less support compared to the Boltzmann model (Figure 5.16).

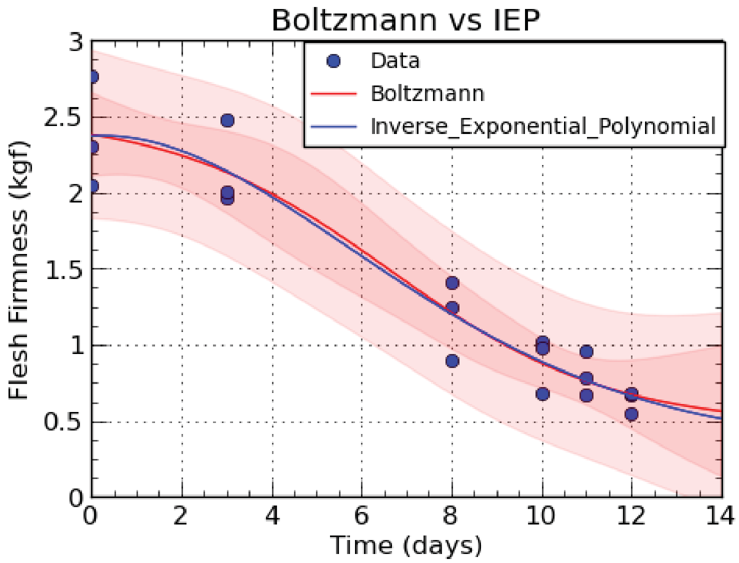


Figure 5.16: Comparison of the Boltzmann and Inverse Exponential Polynomial models fitted to the flesh firmness data collected during storage and transportation of kiwifruit along Supply Chain 1.

Overall, the first best firmness loss model for Supply Chain 1 was the Simple Exponential model, followed by the Boltzmann model and the Inverse Exponential Polynomial model. Table 5.4 shows the equations of the three models along with the AIC_c values and Standard errors

Table 5.4: Overview of firmness loss models for Supply Chain 1

Model	AIC_c value	Standard error	Equation
Simple Exponential	-51.43	0.224	$FF = A_0 + A_1 e^{-\lambda t}$
Boltzmann	-50.65	0.229	$FF = A_0 + \frac{\Delta A}{1 + e^{(t-t_k)/\lambda}}$
Inverse Exponential Polynomial	-43.52	0.241	$FF = \frac{\delta}{1 + e^{(\beta_0 + \beta_1 t + \beta_2 t^2 + \beta_3 t^3)}}$

B. Development of Storage potential models

The flesh firmness (kgf) of kiwifruit was plotted against core temperature (°C). To develop storage potential models, three best non-linear models including the Reciprocal, Reciprocal Quadratic and Power equations were fit to the data (Figure 5.17). Among the three non-linear models, the best fit for the Supply chain 1 dataset was the Reciprocal model.

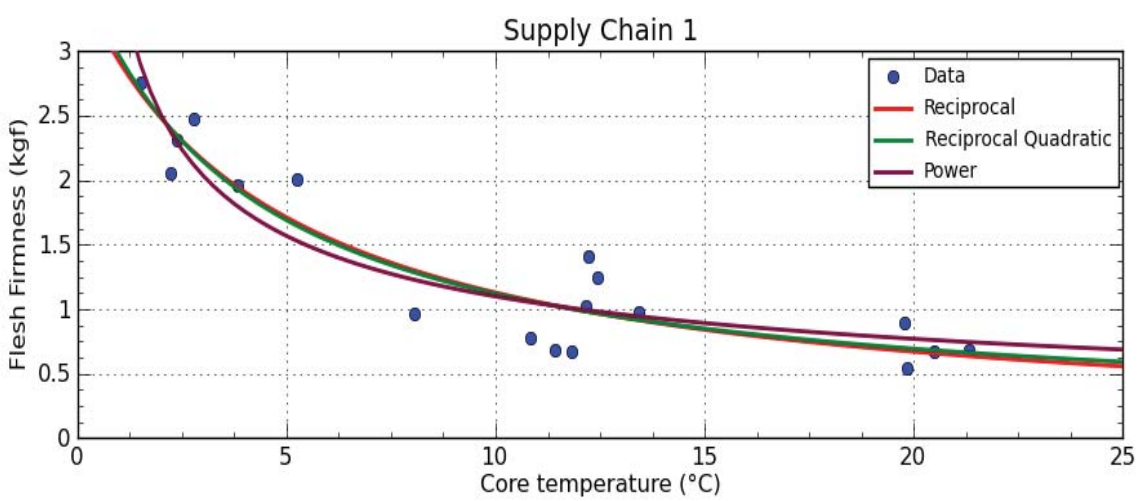


Figure 5.17: Three non-linear models (Reciprocal, Power and Reciprocal Quadratic) fitted to the flesh firmness and core temperature data of kiwifruit collected along Supply Chain 1.

The Reciprocal model was confirmed to be the best model by conducting the AIC test. According to this test, the likelihood that the Reciprocal model was a better model compared to the Reciprocal Quadratic model was 77.59%. The AIC_c values indicated that the Reciprocal model (-49.11) was a better model when compared to the Reciprocal Quadratic model (-46.62). The Δ_i value (2.48) indicated that the Reciprocal Quadratic had considerably less support compared to the Reciprocal model. The probability of Reciprocal Quadratic model being better compared to the Reciprocal model was 22.40% (Figure 5.18).

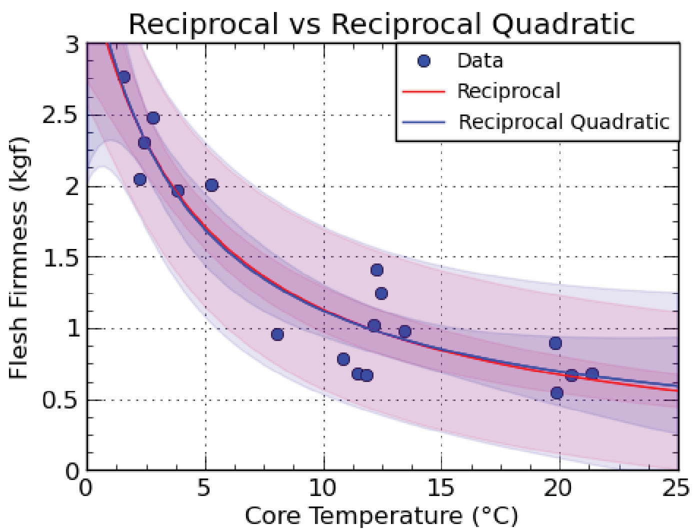


Figure 5.18: Comparison of the Reciprocal and Reciprocal Quadratic models fitted to the flesh firmness and core temperature data of kiwifruit collected along Supply Chain 1.

The Reciprocal model was compared with the Power model using the AIC test, it indicated that the likelihood that the Reciprocal model is a better model compared to the Power model was 74.79%. The probability of the Power model being a better model compared to the Reciprocal model was 25.21%. The AIC_c value for the Reciprocal model (-49.11) was lower than that of the Power model (-46.93), indicating the Reciprocal model to the better model. As the Δ_i value (2.17) was lower than 2 and indicated that the Power model had considerably less support as compared to the Reciprocal model (Figure 5.19).

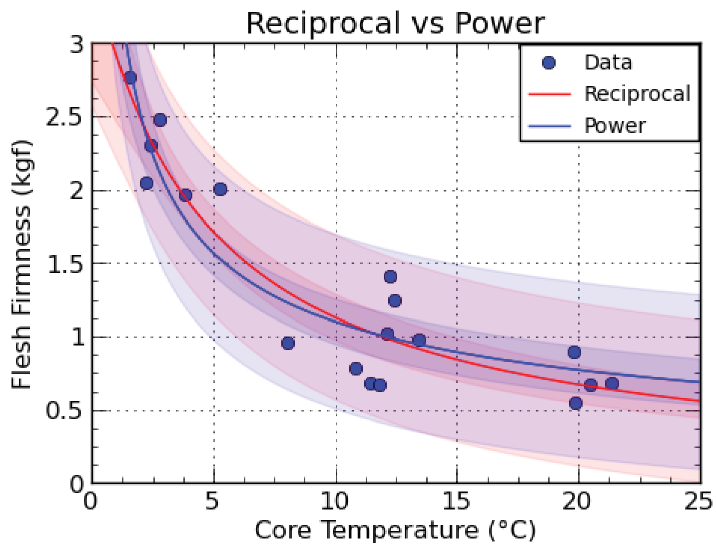


Figure 5.19: Comparison of the Reciprocal and Power models fitted to the flesh firmness and core temperature data of kiwifruit collected along Supply Chain 1.

The AIC test was conducted to determine the second best model for this data. The Power model was the second best fit for Supply Chain 1 dataset. The AIC_c value for the Power model (-46.93) was slightly lower when compared to the value of the Reciprocal Quadratic model (-46.62), indicating the Power model to be a better model fit. The likelihood that the Power model was a better model compared to the Reciprocal Quadratic model was 53.86%. Meanwhile, the probability of the Reciprocal Quadratic model being a better model compared to the Power model was 46.14%. The Δ_i value obtained when the Power and the Reciprocal Quadratic models were compared was 0.3 (< 2). This value suggested substantial evidence for the Reciprocal Quadratic model to be the third best model (Figure 5.20).

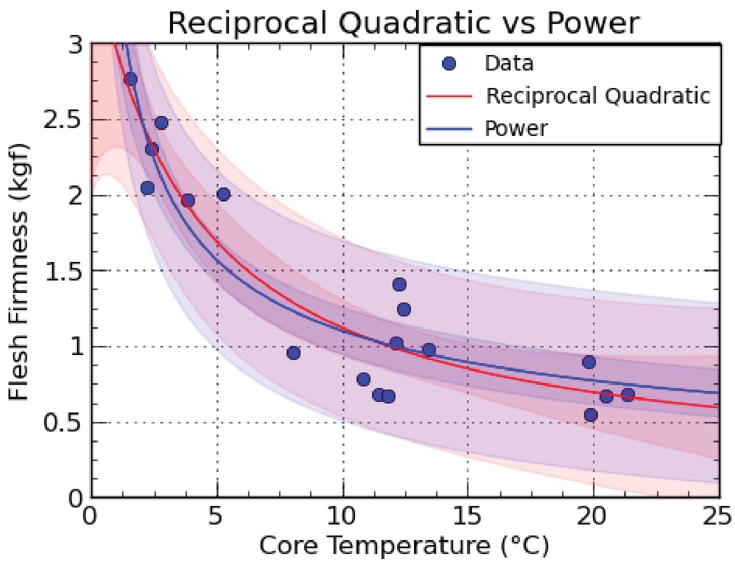


Figure 5.20: Comparison of the Reciprocal Quadratic and the Power models fitted to the flesh firmness and core temperature data of kiwifruit collected along Supply Chain 1.

The model with the lowest standard error was considered as the best model for Supply chain 1 dataset. Among the three non-linear models, the Reciprocal model was ranked first best model, followed by the Power model and the Reciprocal Quadratic model. The overview of the three models indicating the equations, the AIC_c values along with the Standard errors is shown in Table 5.5.

Table 5.5: Overview of storage potential models for Supply Chain 1

Model	AIC_c value	Standard error	Equation
Reciprocal	-49.11	0.254	$FF = \frac{1}{a + bT}$
Power	-46.93	0.271	$FF = a \times b^T$
Reciprocal Quadratic	-46.62	0.282	$FF = \frac{1}{a + bT + cT^2}$

C. 3D modeling to describe the effect of core temperature and SSC on the flesh firmness

A three dimensional graph of flesh firmness (kgf), Brix (% SSC) and core temperature (°C) was constructed in order to understand the effect of temperature and soluble solids content on the flesh firmness of kiwifruit (Figure 5.21). As the core temperature of the fruits increased, the flesh firmness reduced. The flesh firmness reduced as the percentage of soluble solids content increased. The graph indicates that temperature may be responsible for the loss of flesh firmness. This relationship was best described by the Linear Logarithmic model with a low AIC_c value (-45.60) (Figure 5.21).

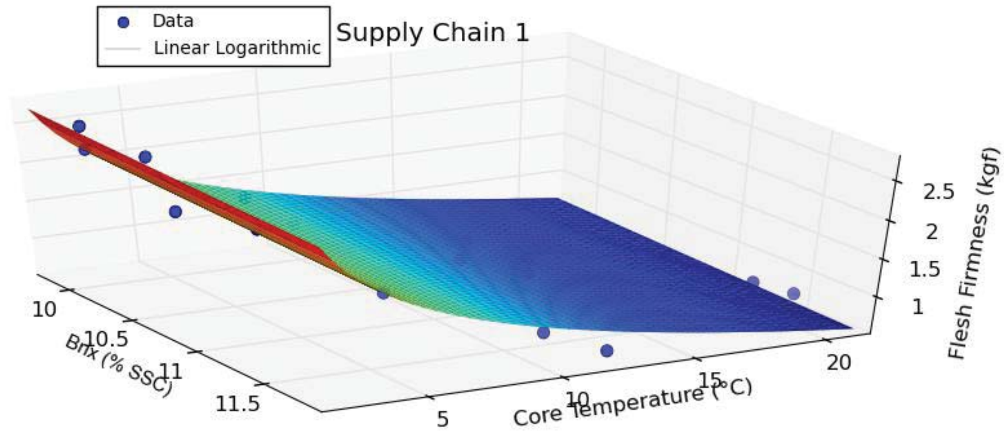


Figure 5.21: Linear Logarithmic model fitted to the flesh firmness (kgf), Brix (% SSC) and core temperature (°C) data of kiwifruit collected along Supply Chain 1.

5.2.2 Supply Chain 2

A. Firmness loss models

Among the three firmness loss models (SE, IEP and Boltzmann), the best model that characterised firmness loss in kiwifruit along Supply Chain 2 was the Boltzmann model (Figure 5.22). When compared with the Inverse Exponential Polynomial model, the likelihood that the Boltzmann model was a better model was 97.47%. Meanwhile, the probability of the IEP model being a better model compared to the Boltzmann model was only 2.53%. The AIC_c value for the Boltzmann model (-48.09) was lower than that of the IEP model (-40.79), confirming that the Boltzmann model was a better model. The Δ_i value (7.30) being > 7, indicated that the IEP model had considerably less support in characterising firmness loss as compared to the Boltzmann model (Figure 5.23).

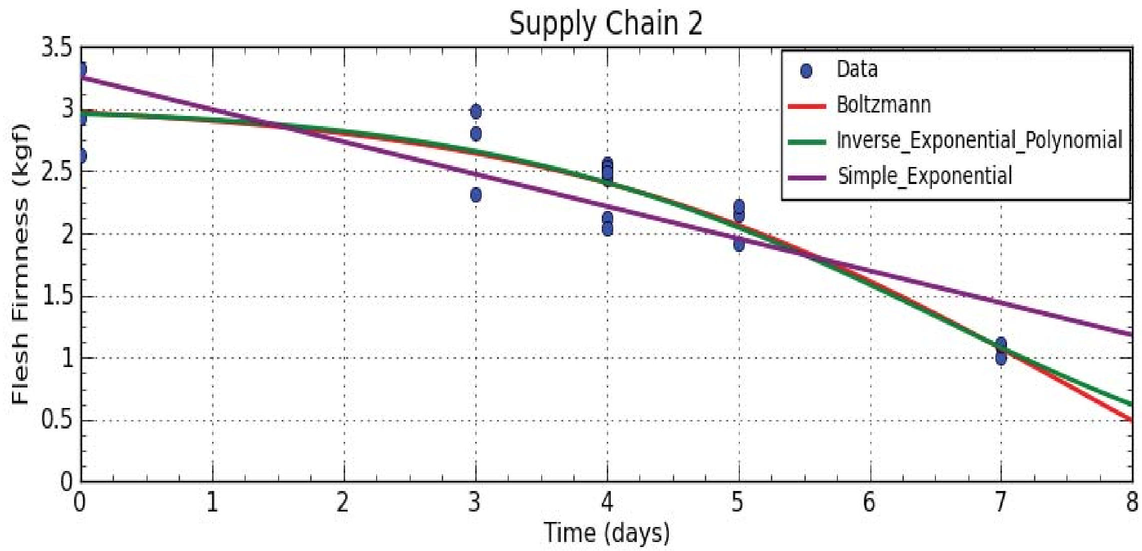


Figure 5.22: Three firmness loss models fitted to the flesh firmness data of kiwifruit obtained during storage and transportation along Supply Chain 2.

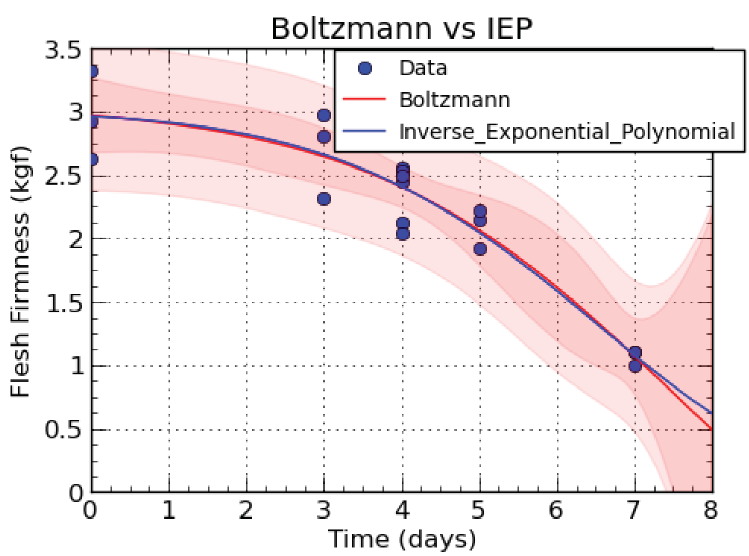


Figure 5.23: Comparison of the Boltzmann and Inverse Exponential Polynomial models fitted to the flesh firmness data collected during storage and transportation of kiwifruit along Supply Chain 2.

According to the AIC test, the likelihood that the Boltzmann model was a better model compared to the Simple Exponential model was 99.68%. The probability of the SE model being a better model compared to the Boltzmann model was only 0.31 %. The second order Akaike Information Criterion (AIC_c) value for the SE model (-36.60) was higher than that of the Boltzmann Model (-48.09) indicating the Boltzmann model is a better model. The Δ_i value (11.49) being > 10, suggested that the SE model was very unlikely to characterise the firmness loss in kiwifruit along Supply Chain 2 (Burnham & Anderson, 2002) (Figure 5.24).

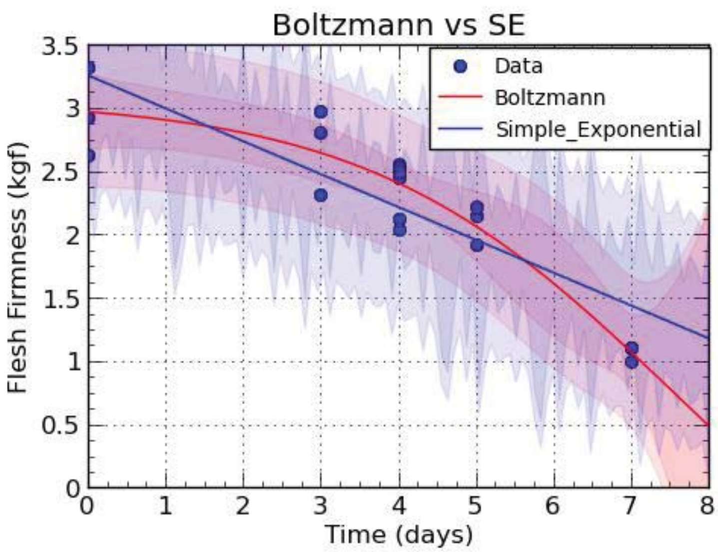


Figure 5.24: Comparison of the Simple Exponential and the Boltzmann models fitted to flesh firmness data collected during storage and transportation of kiwifruit along Supply Chain 2.

The probability of the SE model being a better model compared to the IEP model was 10.95%. Meanwhile, the likelihood that the IEP model was a better model compared to the SE model was 89.04%. The AIC_c value for the IEP model (-40.79) was lower than that of the SE model (-36.60), suggesting that the IEP model was a better model in comparison to the SE model. The Δ_i value (10.45) being >10, indicated that the SE model was very unlikely to characterise firmness loss in kiwifruit along Supply Chain 2 (Figure 5.25). Hence, the IEP was a better model compared to the SE model.

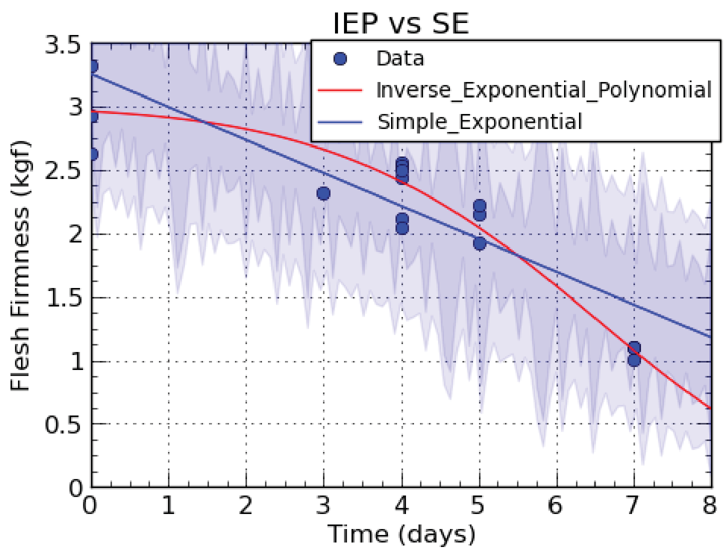


Figure 5.25: Comparison of the Simple Exponential and the Inverse Exponential Polynomial models fitted to flesh firmness data of kiwifruit collected along Supply Chain 2.

The standard error values also indicated that the Boltzmann model was the best model for the Supply Chain 2 dataset, followed by the IEP and the SE models. Table 5.6 shows the equation of the firmness loss models along with AIC_c values and Standard errors for Supply Chain 2.

Table 5.6: Overview of firmness loss models for Supply Chain 2

Model	AIC_c value	Standard error	Equation
Boltzmann	-48.09	0.241	$FF = A_0 + \frac{\Delta A}{1 + e^{(t-t_k)/\lambda}}$
Inverse Exponential Polynomial	-40.79	0.259	$FF = \frac{\delta}{1 + e^{(\beta_0+\beta_1 t+\beta_2 t^2+\beta_3 t^3)}}$
Simple Exponential	-36.60	0.347	$FF = A_0 + A_1 e^{-\lambda t}$

B. Development of storage potential models

Only two storage potential models (Reciprocal and Power) were fitted to the data of flesh firmness and core temperature of kiwifruit along the Supply Chain 2 (Figure 5.26). The Reciprocal Quadratic model was not suitable for the flesh firmness data collected along Supply Chain 2. Between the two fitted models, the Reciprocal model was a better fit compared to the Power model. The AIC_c value of the Reciprocal model (-27.06) was lower when compared to the Power model (-23.18), indicating the former model to be the better fit (Figure 5.27). The Δ_i value (3.87) indicated the Power model had considerably less support for characterising the flesh firmness data as compared to the Reciprocal model. According to the AIC test, the likelihood that the Reciprocal model was better compared to the Power model was 87.42%. The probability of the Power model being a better model compared to the Reciprocal model was only 12.57% (Figure 5.27).

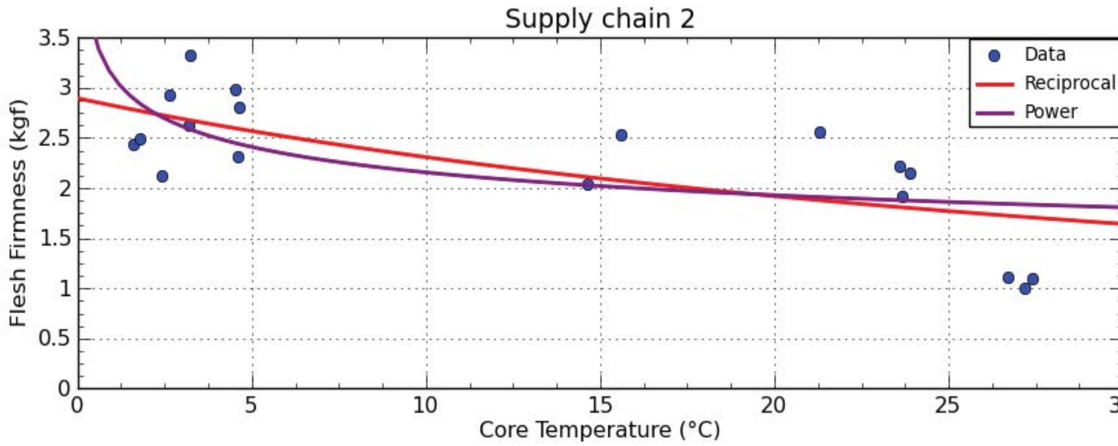


Figure 5.26: Two non-linear models (Reciprocal and Power) fitted to the flesh firmness and core temperature data of kiwifruit collected along Supply Chain 2.

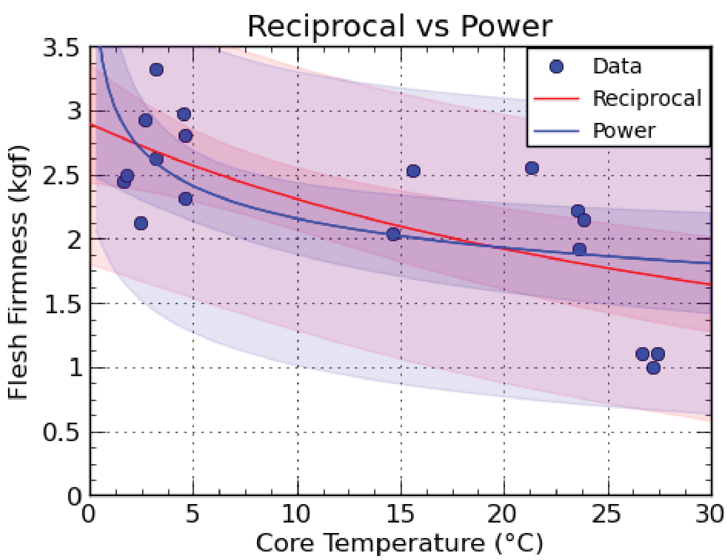


Figure 5.27: Comparison of the Reciprocal and Power models fitted to the flesh firmness and core temperature data of kiwifruit collected along Supply Chain 2.

The best model had lower standard error value and hence, the best model for the Supply Chain 2 dataset was the Reciprocal model followed by the Power model. Table 8 shows the equations of the two non-linear models along with their AIC_c values and Standard errors.

Table 5.7: Overview of storage potential models for Supply Chain 2

Model	AIC_c value	Standard error	Equation
Reciprocal	-27.06	0.469	$FF = \frac{1}{a + bT}$
Power	-23.18	0.523	$FF = a \times b^T$

C. 3D modeling to describe the effect of core temperature and SSC on the flesh firmness

A three dimensional graph of flesh firmness, core temperature and Brix (% SSC) variations along Supply chain 2 was plotted. These data were fitted with a non-linear model to understand the effects of core temperature and soluble solids content on the flesh firmness of the fruit. As the core temperature increased the flesh firmness of the fruit decreased. The Linear Logarithmic model was considered the best model fit for the 3D graph as the AIC_c test value (-21.57) was the least for this model (Figure 5.28).

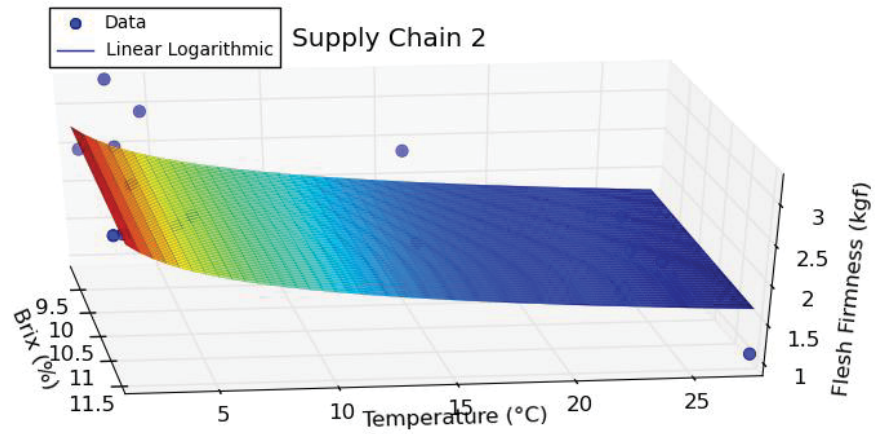


Figure 5.28: Linear Logarithmic model fitted to the flesh firmness (kgf), Brix (% SSC) and core temperature (°C) data of kiwifruit collected along Supply Chain 2.

5.2.3 Supply Chain 3

A. Firmness loss models

The Boltzmann, Simple Exponential and Inverse Exponential models were fitted to the flesh firmness data collected during storage and transportation of kiwifruit along Supply Chain 3. The best model which characterised the data was the Simple Exponential model followed by the Boltzmann model and the Inverse Exponential Polynomial (Figure 5.29).

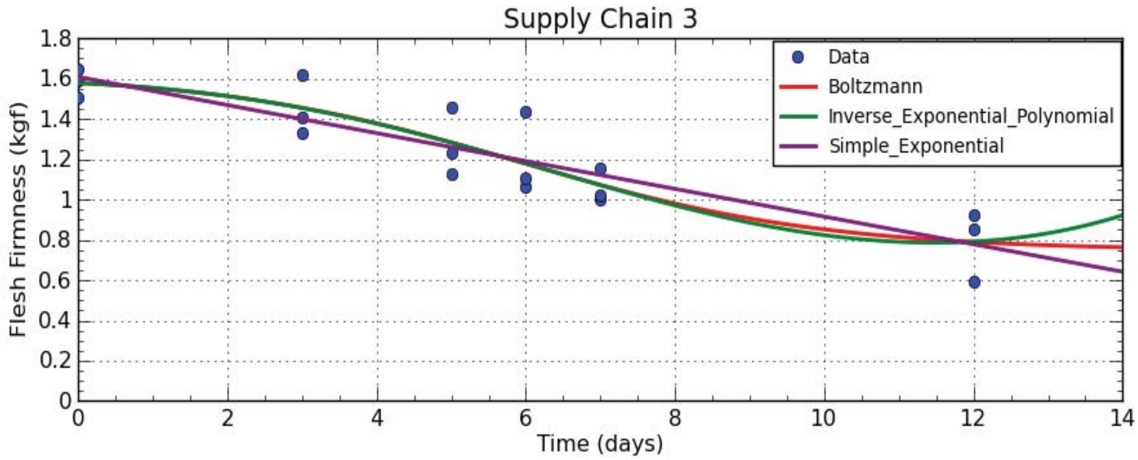


Figure 5.29: Three firmness loss models fitted to the flesh firmness data of kiwifruit obtained during storage period and transportation along Supply Chain 3.

Simple Exponential model best described the data, as the AIC_c value was the lowest compared to that of the Boltzmann and the IEP models. The likelihood that the SE model was the better model compared to the Boltzmann model was 68.26%. The AIC_c value of the SE (-69.29) was lower than that of the Boltzmann model (-67.76). The Δ_i value (1.53) was < 2, further suggesting substantial evidence that the Boltzmann model was the second best model fitted to the flesh firmness data (Figure 5.30). The probability of the Boltzmann model being a better model compared to the SE model was 31.73%.

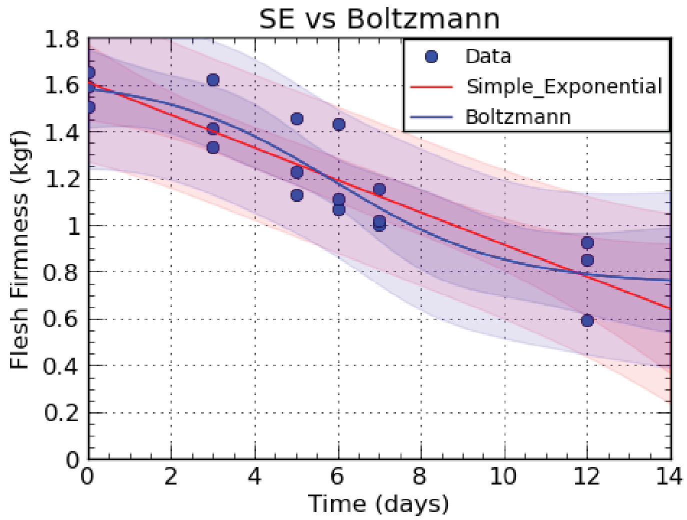


Figure 5.30: Comparison of Simple Exponential and Boltzmann models fitted to the flesh firmness data collected during storage and transportation of kiwifruit along Supply Chain 3.

The likelihood that the SE model is the better model compared to the IEP model was 98.78%. The calculated AIC_c value for the SE model (-69.29) was lower than the IEP (-60.49), indicating that the SE model was a better model than the IEP model. The Δ_i value (8.799) suggested that the IEP model had considerably less support in characterising the firmness loss data compared to the SE model. The probability of IEP model being a better model compared to SE model was only 1.21% (Figure 5.31).

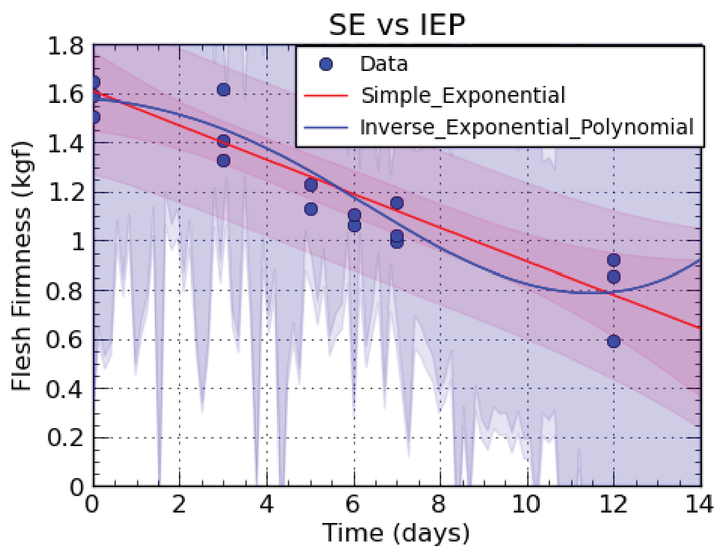


Figure 5.31: Comparison of Simple Exponential and Inverse Exponential Polynomial models fitted to the flesh firmness data collected during storage and transportation of kiwifruit along Supply Chain 3.

When comparing the IEP model and the Boltzmann models, the latter model showed to be a better fit for Supply Chain 3 dataset. The likelihood that the Boltzmann model was a better model as compared to the IEP model was 97.42%. The AIC_c value (-67.76) for the Boltzmann model was lower than the AIC_c value (-60.49) for the IEP model, further indicating that the Boltzmann model was a better fit for the data. The Δ_i value (7.26) was greater than 7 indicating that the IEP model had considerably less support in characterising the flesh firmness data compared to the Boltzmann model. The probability of IEP model being better compared to the Boltzmann model was only 2.57% (Figure 5.32). Table 5.8 shows the equations of the three firmness loss models with their corresponding AIC_c values and standard errors.

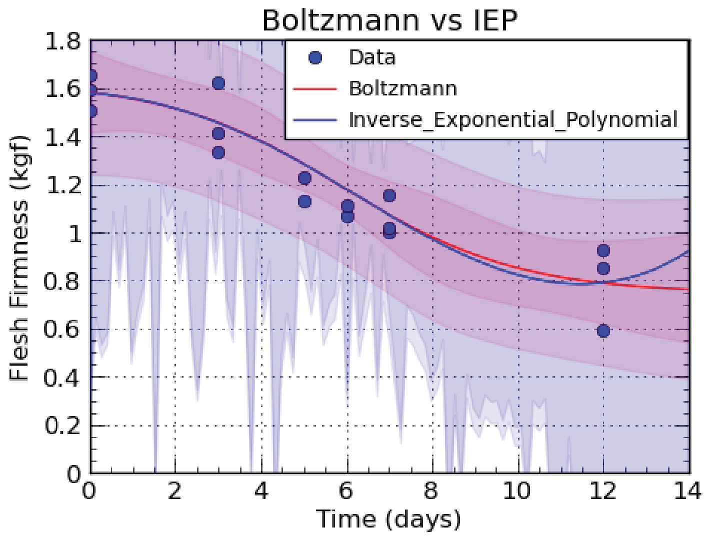


Figure 5.32: Comparison between Boltzmann and Inverse Exponential Polynomial models fitted to the flesh firmness data collected during storage and transportation along Supply Chain 3.

Table 5.8: Overview of firmness loss models for Supply Chain 3

Model	AIC_c value	Standard error	Equation
Simple Exponential	-69.29	0.139	$FF = A_0 + A_1 e^{-\lambda t}$
Boltzmann	-67.76	0.139	$FF = A_0 + \frac{\Delta A}{1 + e^{(t-t_k)/\lambda}}$
Inverse Exponential Polynomial	-60.49	0.150	$FF = \frac{\delta}{1 + e^{(\beta_0 + \beta_1 t + \beta_2 t^2 + \beta_3 t^3)}}$

B. Development of storage potential models

The three models (Reciprocal, Reciprocal Quadratic and Power) were fitted to the data on flesh firmness and core temperature collected along the Supply Chain 3. The best fitted model for this dataset was the Reciprocal model, followed by the Power and the Reciprocal Quadratic models (Figure 5.33). The likelihood that the Reciprocal model was a better fit compared to the Power model was 57.15% (Figure 5.34). The Power model had a higher AIC_c value (-63.30) compared to the Reciprocal model (-63.88), indicating the latter model to be a better fit. The difference in the AIC_c (Δ_i) value (0.57) indicated that the Power model could be the second best fit for the flesh firmness and core temperature data (Figure 5.34).

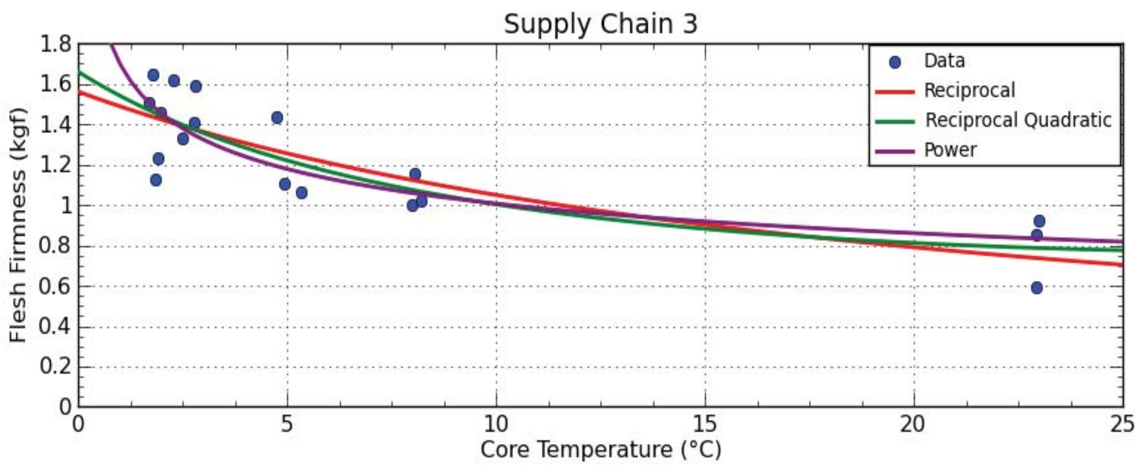


Figure 5.33: Three non-linear models (Reciprocal, Power and Reciprocal Quadratic) fitted to the flesh firmness and core temperature data of kiwifruit collected along Supply Chain 3.

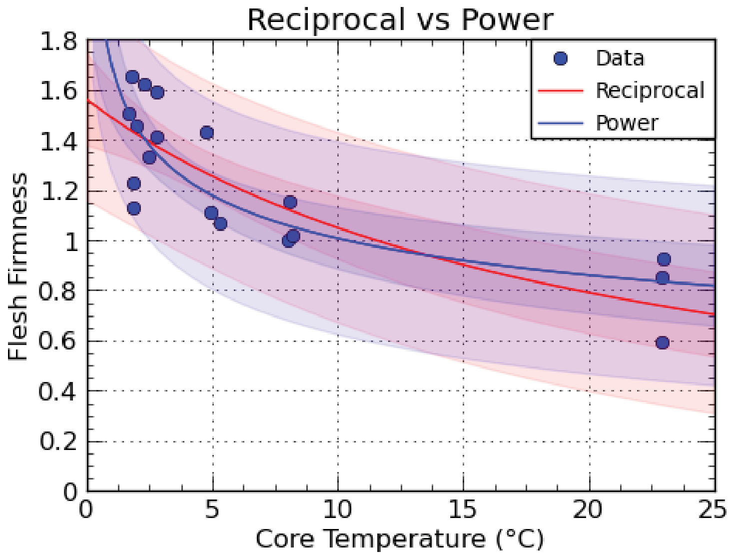


Figure 5.34: Comparison of the Reciprocal and the Power models fitted to flesh firmness and core temperature data of kiwifruit collected along Supply Chain 3.

A comparison between the Reciprocal and the Reciprocal Quadratic models was obtained by conducting the AIC test. The Reciprocal model had an AIC_c value of -63.88, which was lower than the AIC_c value (-62.20) of the Reciprocal Quadratic model. This indicated that the Reciprocal model was a better fit compared to the Reciprocal Quadratic model (Figure 5.35). The Δ_i value being 0.16 (< 2), thus demonstrating the potential of the Reciprocal Quadratic model to be used as storage potential model for Supply Chain 3.

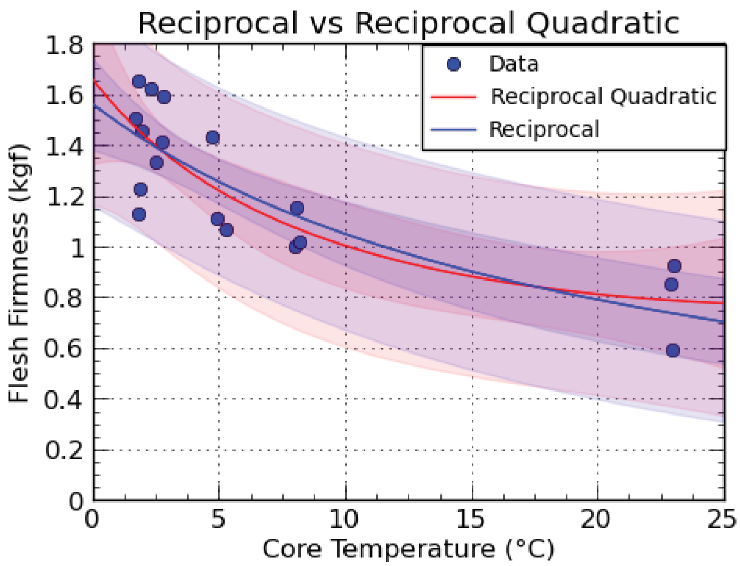


Figure 5.35: Comparison of Reciprocal and Reciprocal Quadratic models fitted to the flesh firmness and core temperature data of kiwifruit collected along Supply Chain 3.

The second best model which fitted the Supply Chain 3 data was the Power model. The AIC test indicated that the likelihood that the Power model was a better model compared to the Reciprocal Quadratic was 63.42% (Figure 5.36). The AIC_c value of the Power model (-63.30) was slightly lower than that of the Reciprocal Quadratic model (-62.20), indicating the Power model to be a better fit compared to the Reciprocal Quadratic model. The difference in AIC_c value (1.10) was lower than 2, which suggested substantial evidence that the Reciprocal Quadratic model could be used as the storage potential model for predicting kiwifruit shelf-life.

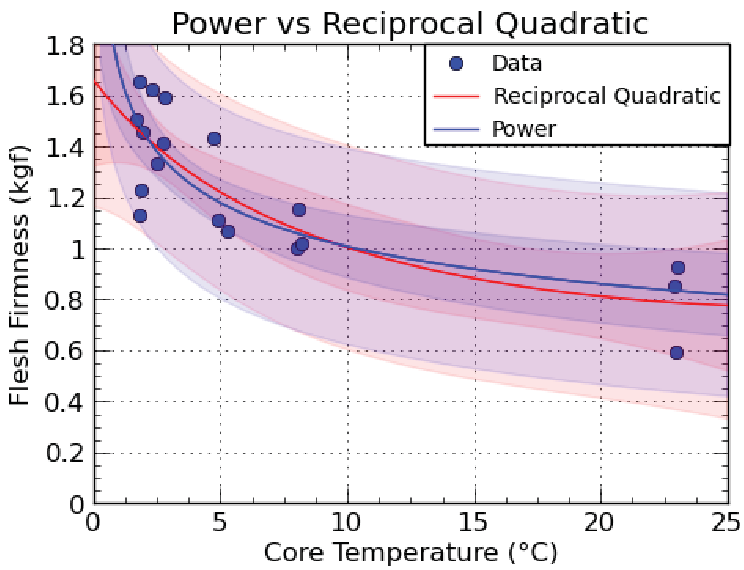


Figure 5.36: Comparison of Power and Reciprocal Quadratic models fitted to the flesh firmness and core temperature data of kiwifruit collected along Supply Chain 3.

The AIC_c values and the standard error values indicated that the best fit model for Supply Chain 3 dataset was the Reciprocal model, followed by the Power and the Reciprocal Quadratic models. Table 5.9 shows the storage potential models with the calculated AIC_c values and standard errors.

Table 5.9: Overview of storage potential models for Supply Chain 3

Model	AIC_c value	Standard error	Equation
Reciprocal	-63.88	0.169	$FF = \frac{1}{a + bT}$
Power	-63.30	0.170	$FF = a \times b^T$
Reciprocal Quadratic	-62.20	0.170	$FF = \frac{1}{a + bT + cT^2}$

C. 3D modeling to describe the effect of core temperature and SSC on the flesh firmness

A non-linear model was fitted to the data of flesh firmness (kgf), Brix (% SSC) and core temperature (°C) of kiwifruit (Figure 5.37). This model helps to understand the effect of temperature and soluble solids content on the flesh firmness of the fruit. The flesh firmness reduced while the core temperature increased. As soluble solids content increased, the flesh firmness of the fruit decreased. The Linear Logarithm model was the best fit model to the data as the AIC_c value (-73.66) was the least for this model (Figure 5.37).

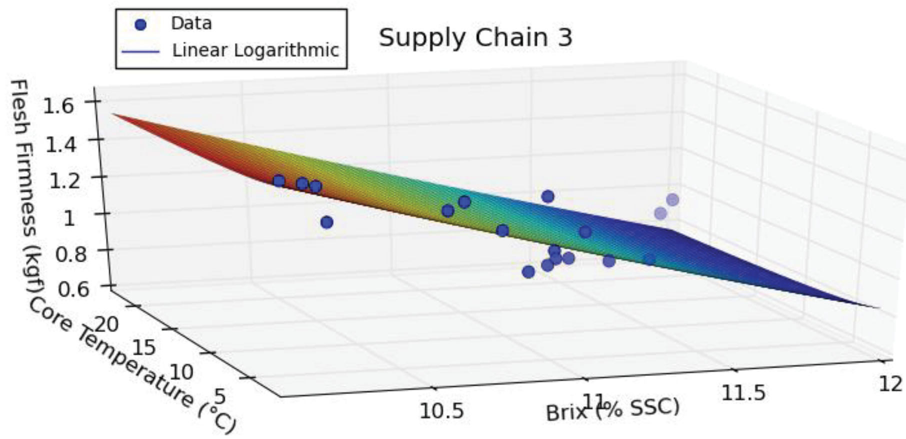


Figure 5.37: Linear Logarithmic model fitted to the flesh firmness (kgf), Brix (% SSC) and core temperature (°C) data of kiwifruit collected along Supply Chain 3.

6.0 DISCUSSION

6.1 Flesh firmness change during storage and transportation of kiwifruit

Many physiological processes in kiwifruit contribute to fruit softening including the swelling of cell wall and its breakdown, the hydrolysis of starch and decrease in water and osmotic potential. Of these, the most important physiological change leading to softening of kiwifruit, and in many other fruits, is the loss of the integrity of the cell wall (Arpaia, Labavitch, & Kader, 1987; Bourne, 1982; Fisher & Bennett, 1991; Redgwell & Fry, 1993; Shackel, Greve, Labavitch, & Ahmadi, 1991). Other than physiological processes, several preharvest factors may also influence the softening behaviour of kiwifruit during storage. However, studies dealing with these preharvest factors have not been conclusive on the matter of an involvement of them in premature softening. Along with the physiological and preharvest factors influencing the softening of kiwifruit, postharvest factors also affect the storage behaviour of kiwifruit (Benge, 1999). For most fruits, temperature has a major effect on the rate of ripening. Respiration rates decrease as the fruit temperature is reduced from ambient to 0°C (Bourne, 1982). As the respiration rate reduces, the rate of ripening decreases (Fukui, Noda, & Yamada, 1976; Heatherbell, 1975). Therefore, one of the main aims in storage is to reduce fruit temperature and respiration to slow the rate of ripening.

The flesh firmness of kiwifruit reduced significantly ($P<0.05$) with increase in storage and transportation time. As the environmental temperatures increased during storage and transportation along the three supply chains, the flesh firmness decreased. Along Supply Chains 1 and 3, the flesh firmness reached below the recommended minimum export firmness (1 kgf) when the environmental temperatures reached above 20°C. As the environmental temperatures increased with storage and transportation time, an exponential loss of firmness was observed. Similar results were observed in a study conducted by Feng et al. (2007). The flesh firmness decreased as an exponential function of cumulative degree-days (DD) (temperature-time), during storage at 0.5°C, 10°C, 15°C and 20°C (Feng, Brown, MacKay, & Maguire, 2007). As the storage temperatures increased, the rate of softening increased exponentially. This indicated that fruit stored at lower temperatures had better storage potential compared to the fruit stored at stored at higher temperatures (Feng et al., 2007). Therefore, this explains the significant decrease in the flesh firmness

Significant (P<0.05) reduction in flesh firmness was observed in this study, with values reaching below 1 kgf, as the environmental temperature during storage and transportation increased rapidly, reaching above 20°C. The drop in flesh firmness was significant as the temperatures increased along the supply chains. The observations made along the three supply chains indicate that, the initial firmness loss in fruit stored below 5°C was comparatively lower than the firmness loss in fruit stored above 15°C. A similar observation was made in a study conducted by Beever and Hopkirk in 1990, which indicated that the rate of fruit softening in kiwifruit stored at 20°C is high as compared to those fruits stored at 0°C. Even though at 0°C, packed fruits soften rapidly from a flesh firmness of 8 kgf to 3 kgf in 4 to 6 weeks, the rate of softening is slowed considerably if the temperature is maintained at 0°C (Beever & Hopkirk, 1990). But at 20°C, initial rate of softening is greater than that at 0°C, and this rate is maintained, leading to rapid softening of the fruit (Beever & Hopkirk, 1990). Hence, maintaining the storage and transportation temperatures at 0°C will reduce the softening rate and thus improve the storage potential of kiwifruit.

The results of this study suggest that fruit soften rapidly as the environmental temperatures increased above 20°C. Along Supply Chain 2, the firmness of the fruit belonging to the three grower lines reduced by about 1.5 kgf within 3 days of storage (>20°C) at the retail market indicating that the shelf-life of the fruit reduces with increase in temperature. The reduction in flesh firmness and thus the reduction in the shelf life of kiwifruit in this study are similar to the findings by Lallu (1989). According to Lallu (1989), one of the key storage factors that affect the storage potential of kiwifruit is the storage temperature. Kiwifruit are best stored at 0°C but fruit softening rate begins to increase at temperatures above the 0°C point. When kiwifruit is stored at 4°C, the storage life may be reduce by one month when compared to the fruit stored at 0°C. A 5°C rise can double the respiration rate and thus halve the storage life (Lallu, 1989). Work done by Hong and Lee in 1994 also showed that the shelf-life of 'Hayward' kiwifruit stored at room temperature (25°C) is only one week (Hong & Lee, 1994).

Ethylene regulates many biochemical activities in fruit development and ripening and is biologically active in minute quantities. All plant tissues are capable of producing ethylene, although the rate of production is normally low (Kupferman, 1986). The ethylene production can be stimulated by either internal or external factors. Studies have indicated that kiwifruit contains negligible ethylene content at harvest and the fruit is very sensitive to postharvest ethylene treatment, showing a typical pattern of increase in ethylene production accompanied by an increase in respiration (Hyudo & Fukasawa, 1985; Park, 1996; Park & Kim, 1995; Park & Kim, 2002). The ripening of kiwifruit can be induced by a very low concentration (as low as 0.1 ppm) of exogenous ethylene (Beever & Hopkirk, 1990; McDonald, 1990) and therefore causing the rapid softening of fruit. Though ethylene production was not analysed in this study, significant reduction in flesh firmness of kiwifruit observed along Supply Chains 1 and 3 could be due to the increased production of endogenous ethylene in the fruit.

In this study, kiwifruit were stored and transported with apples and oranges along Supply Chains 1 and 3. In apples, one of the most rapid changes in chemistry and physiology is the accelerated production of ethylene as fruit ripens. Prior to initiation of the ripening process, ethylene production rates are low, with internal ethylene concentrations below 0.15 parts per million (ppm). As ripening begins, defined by changes in respiration, the rate of ethylene production increases rapidly reaching more than 100-fold within 2 days (Kupferman, 1986; Thompson., 2003a). In oranges, respiration rates increase rapidly with increase in temperature, thereby leading to increased production of ethylene (Thompson., 2003a). The presence of apples and oranges along with kiwifruit could have increased the endogenous ethylene production in kiwifruit, thereby ripening the fruit at a faster rate. Therefore, kiwifruit should be stored away from other fruits, as it is very sensitive to the ethylene emitted by other fruits.

Ethylene biosynthesis and kiwifruit softening following different postharvest treatment was studied by Tonutti et al. (1993). 'Hayward' kiwifruit harvested between 6.0% and 6.5% SSC and held at 4°C overnight were placed in a glass jar and exposed to air and ethylene with enhanced airflows at 20°C. Rapid fruit softening was observed after 10 days in the presence of ethylene, while the fruit stored in air softened after 14 days (Tonutti & Bonghi, 1993). A study conducted by Beever (1993) indicated that ripening of kiwifruit occurs rapidly at ambient temperature especially in the presence of ethylene gas, but slows at lower temperatures (Beever, 1993). Results of this study support that, the presence of ethylene along with high temperatures increases the softening of kiwifruit, thereby providing a reason for the decrease in the flesh firmness.

Reduction in flesh firmness observed in this study could also be due to the increase in soluble solids content of kiwifruit along the supply chains. As the storage and transportation temperatures increased along the supply chains, the soluble solids content increased significantly ($P<0.05$). This increase in SSC could have altered the cell wall integrity in the fruit, thereby causing a significant reduction in the flesh firmness. Several studies have indicated that degradation of starch to simple sugars have some effect on fruit firmness reduction by altering the cell turgor (Arpaia et al., 1987; Beever & Hopkirk, 1990; Bonghi, Pagni, Vidrih, Ramina, & Tonutti, 1996). As starch degrades, cell osmotic pressure increases which may influence cell wall flexibility (Benge, 1999).

A study conducted by Harker and Hallet (1994) investigated the flesh firmness decline in kiwifruit at cellular level. An initial rapid reduction in flesh firmness from 8 to 2.7 kgf was observed during 6 weeks of storage at 0°C. This reduction was related to a reduction in the adhesion between cells in the outer pericarp tissue. Within 23 additional weeks of storage at 0°C, flesh firmness decreased from 2.7 kgf to 0.5kgf. The final stage of softening was associated with an increase in the proportion of cells that separated at the middle lamella and an increase in the plasticity of the cell wall (Harker & Hallet, 1994). Therefore, the significant increase in the soluble solids content due to starch degradation might have influenced the firmness reduction in kiwifruit along the supply chains in this study.

Moras et al (1991) studied the storage potential of kiwifruit, which indicated that fruit firmness decreased to the level of commercial acceptability (1 kgf) after 4 months of storage in air at 0.5°C (Moras, Bony, Rothan, & Nicolas, 1991). But in this study, the flesh firmness of the fruit decreased to the commercial acceptability (1 kgf) within 6-8 days during storage and transportation along the supply chains. This significant decrease in flesh firmness is due to the increase in environmental temperatures along the supply chains. The above mentioned studies have indicated that temperature is one of the most important environmental factors influencing the storage potential and quality of kiwifruit. Increase in temperature influences the respiration and ethylene production rates, which enhances the ripening process in kiwifruit. This leads to the loss of flesh firmness and quality deterioration of the fruit (Moras & Nicolas, 1987). This explains the importance of maintaining optimal temperature (0°C) (Ferguson & Stanley, 2003; Kader, 2002; Kader et al., 1996; Mitchell, 1979) along the kiwifruit supply chains.

6.2 Changes in Soluble Solids Content during storage and transportation of kiwifruit

Many physiochemical parameters change during storage due to respiration of the fruit. These parameters are considered to be important factors in terms of quality at the consumption stage (Lallu, 1989; Tavarini et al., 2008). Studies have indicated the increase in soluble solids content (%Brix) and reduction of flesh firmness in 'Hayward' kiwifruit during cold storage at 0°C (Lloret, Alavoine, Mornas, Crochon, & Morin, 1990; Manolopoulou & Papadopoulou, 1998), which is coherent with the results obtained in this study. A significant ($P<0.05$) increase in soluble solids content was observed in kiwifruit along the three supply chains. The increase in SSC is due to the degradation of starch to simpler sugars which is the most important phenomena observed during ripening process in kiwifruit.

Along Supply Chain 1, the soluble solids content increased significantly with values reaching as high 11.5% at the end of 12 days. Similar increase in SSC was observed along Supply Chain 3, wherein the levels were as high as 12.0% by the end of 12 days. The soluble solids content increased much rapidly in kiwifruit along Supply Chain 2. As the environmental temperature during storage and transportation increased, the SSC increased significantly to 11.8% within 7 days. This indicated that increase in temperature increased the starch degradation and thereby increasing the SSC. Similar observations were made in other studies (Chiaramonti & Barboni, 2010; Feng et al., 2007) as well . A study conducted Feng et al. (2007), indicated that the soluble solids content increased as an exponential function of the cumulative degree-days (DD) (temperature-time) of the storage at 0.5°C, 10°C, 15°C and 20°C (Feng et al., 2007). A study conducted by Chiaramonti & Barboni (2010) indicated that even at 0°C, soluble solids content increased significantly. After 29 weeks of storage at 0°C, the soluble solids content (Brix) increased from 6.0 to 15.1% (Chiaramonti & Barboni, 2010). While the minimum recommended levels of sugar for kiwifruit are between 12-14% (Lloret et al., 1990; Tavarini et al., 2008).

The significant increase in SSC of kiwifruit with increase in temperature observed in this study could possibly be due to the enzymatic activity. A study conducted by Wang et al. (1994) investigated the relationship between amylase activity and softening of kiwifruit after harvest. The softening of kiwifruits (cultivars 'Hayward' and Qinmei) were be divided into 2 phases. The first phase (rapid phase) involved rapid softening accompanied by starch hydrolysis and an increase in total amylase activity (Wang, Han, & Liang, 1994). In the second phase (slow phase) starch hydrolysis was almost complete and the rate of softening slowed. The reason for increased amylase activity could be due to physical injury, ethylene exposure and increase in storage temperature. Increase in temperature can enhance the enzyme (amylase) activity, leading to increased starch degradation (Wang et al., 1994).

As the SSC content increased in kiwifruit along each supply chain, the flesh firmness of the fruit decreased significantly ($P<0.05$). The flesh firmness of kiwifruit decreased by about 1.8 kgf when their soluble solids content increased by about 2%. This was also observed in a study conducted by Redgwell and Percy (1992). It was demonstrated that the starch content decreased by 20% leading to firmness loss from 10 kgf to 7.8 kgf (Redgwell & Percy, 1992). Hydrolysis of starch during the rapid phase probably makes some contribution to overall softening. During this phase, large amounts of pectins in the cell walls are solubilised and the hemicelluloses reduce in size with concomitant reduction in the integrity of the cell walls. By the time the slow phase is reached, all the pectin has solubilised but the reduction of pectin chain length continues through this phase. At the end of this phase, the middle lamella would mostly be disintegrated (Jordan & Loeffen, 2009). Hence, degradation of starch increases the osmotic pressure which may influence the cell wall flexibility (Benge, 1999).

Results obtained in this study indicated that, SSC increased rapidly during the transportation of kiwifruit along with apples and oranges. Presence of apples and oranges during the transportation of kiwifruit along Supply Chains 1 and 3 could have exposed the fruit to an ethylene-rich environment, leading to rapid ripening process, thereby increasing the SSC significantly. In another study in 2005, fruits were harvested at 8-10% SSC and stored at 2°C in the presence of pears, and thus were likely exposed to an ethylene-rich environmental. Under these conditions, fruits ripened quickly with SSC reaching about 15% with one week of storage (Fisk, Silver, Strik, & Zhao, 2008). This was indicative of the fact that ethylene accelerates the fruit ripening process and that kiwifruit is responsive to concentrations of ethylene as low as 0.1 ppm, even under low temperatures and controlled environments (Beever & Hopkirk, 1990; McDonald & Harman, 1982).

In 'Hayward' fruit, 81% of the firmness was lost during the first 8 weeks of storage in air at 0°C. Starch degradation into simple sugars also occurred simultaneously with softening. A comparison of changes in the cell wall components of air stored and CA-stored fruit suggested that, in addition to cell wall degradation processes contributing to the fruit softening, starch degradation (possibly causing cell turgor changes) may also be involved in low-temperature softening (Arpaia et al., 1987). The results of the above mentioned studies indicate that storage temperature and presence of ethylene influence the starch degradation, thereby increasing the soluble solids content of kiwifruit. This clearly explains the significant ($P<0.05$) increase in SSC observed in this study along the three supply chains.

6.3 Modelling softening of kiwifruit

The softening behaviour of *Actinidia deliciosa* fruit typically follows a sigmoid shaped curve, which is characterised by a period of little softening (lag phase), then rapid softening followed by gradual softening (White, Silva et al., 2005). When kiwifruit are harvested, their firmness generally ranges between 11 and 6 kgf but are not ready for consumption until the firmness decreases below 1 kgf. The largest change in firmness takes place during the rapid phase and the second phase of softening starts when the firmness is about 2 kgf and slowly decreases until the fruit are over-ripe (Jordan & Loeffen, 2009).

Many researchers have used mathematical models and algebraic descriptions of the trends of softening experienced by kiwifruit during their life from vine to consumption. The Simple Exponential model is a typical mathematical model which has been widely used in predicting the storage life of kiwifruit (Benge et al., 2000; Feng, MacKay, & Maguire, 2001; Feng, MacKay, Maguire, Benge, & Jeffery, 2003; Jordan & Loeffen, 2007, 2008; Schotsmans, MacKay, & Mawson, 2008). A study conducted by Feng et al. (2001) used the Simple Exponential model for calculating the storage life of 'Hayward' kiwifruit. Fruit softening is considered as a major limiting factor in the storage life of 'Hayward'. The estimation of storage time (from harvest time to the time the fruit reaches about 1 kgf) by fitting a straight line between data points prior to and after softening to the threshold or tri-phasic curves leads to errors. Therefore, reduction fruit firmness for storage for more than 3 months being exponentially related to time (days) after harvest, was best characterised by the Simple Exponential model (Feng et al., 2001). This finding was further used in another study in which rationalized methodologies were suggested to investigate kiwifruit storage life (Feng, MacKay et al., 2003).

In our study the Simple Exponential model best characterised the data on firmness reduction for Supply Chains 1 and 3. However, the Simple Exponential model was not suitable for the Supply Chain 2 dataset, which may be attributed to lack of spread of analysis points. Also the storage and transportation time (8 days) along Supply Chain 2 was lower than Supply Chains 1 and 3 (12 days). The Simple Exponential model was also used in other studies (Benge et al., 2000; Feng et al., 2007; Schotsmans et al., 2008) and the model best characterised the firmness loss data collected. In a study conducted by Feng et al. (2007) it is suggested that decrease in flesh firmness of 'Hayward' kiwifruit is an exponential function of cumulative degree-days (temperature-time) during storage at 0.5°C, 10°C, 15°C and 20°C (Feng et al., 2007) and a study by Benge et al. (2000) indicated that the SE model characterised the firmness data well. The Simple Exponential model was also used describe the softening showed by 'Hayward' kiwifruit during storage at six temperatures ranging from 1.5°C to 25°C (Schotsmans et al., 2008). Therefore, an exponential function was used as a mathematical model in our study to predict the firmness loss along each supply chain.

The shelf-life of kiwifruit was estimated using the Simple Exponential model in a study conducted by Feng et al. in 2006. The Simple Exponential model was fitted to the data collected for 3 to 6 months of storage and the time at which the curve passed through 0.85 kgf was determined (Feng, Maguire, & MacKay, 2006). This study indicated that the Simple Exponential model was ideal to fit the firmness data during the second exponential phase of softening, which starts at a flesh firmness of 2 kgf. In our study, the initial flesh firmness of the kiwifruit was about 2 kgf expect for the firmness of fruit along Supply Chain 2. Therefore, Simple Exponential model best characterised firmness loss along the Supply Chains (1 and 3), and the reduction in flesh firmness along the supply chains was exponential. A study conducted by Lill et al. (1992), also used the Simple Exponential model to predict the softening rate of kiwifruit (Lill & Hodson, 1992).

The Boltzmann model was the second best model which fit firmness data of Supply Chains 1 and 3. This model has been used in previous studies to predict the storage life of kiwifruit (White et al., 2007; White, de-Silva et al., 2005; White, Silva et al., 2005). This model is also known as the logistic sigmoid function or logistic sigmoid growth, which is usually described as sigmoid. Since the softening behaviour of 'Hayward' fruit typically follows a sigmoid shaped curve, the Boltzmann model would be one of the best models that can be used in predicting softening curves of kiwifruit. In a study conducted by White et al. (2005), the Boltzmann model was fitted to the flesh firmness data collected during ripening of kiwifruit at 20°C following nine weeks of storage at 1°C. The model was used to estimate the steepness of the softening curve.

The Boltzmann model was also used in another study by Jordan & Loeffen (2007 & 2008). The model was used as a part of the piecewise model. The Boltzmann and Simple Exponential models were used in combination to describe the different phases of softening and these two models were integrated at two junction points or knots in such a way that the firmness matched in terms of both height and slopes at these points (Jordan & Loeffen, 2007, 2008). This study indicated that the Boltzmann model was ideal for characterising the slow softening phase, that is when the kiwifruit softens from 6 kgf to about 2 kgf. In our study, the initial flesh firmness of the fruit were below 2 kgf expect for the fruit along Supply Chain 2 (greater than 2 kgf). Therefore, the Boltzmann model best characterised the Supply Chain 2 firmness data.

The Inverse Exponential Polynomial was the third firmness loss model fitted to the flesh firmness data along each supply chain. This model has been used in various other studies to model the softening curves of kiwifruit (Benge et al., 2000; White et al., 2007; White, Silva et al., 2005). The Inverse Exponential Polynomial model was one of the best models which characterised the firmness data in the study conducted by Benge et al. (2000). In this study, various models including Exponential Decay, Complementary Gompertz (CG), Complementary Michaelis-Menten (CMM), Jointed Michaelis-Menten (JMM) and Inverse Exponential Polynomial (IEP) were used to characterise the firmness reduction in kiwifruit from the time of harvest. Among these models, the IEP model was one of the best models that characterised the softening of kiwifruit. This model was further examined with the purpose of indentifying the reason for prediction and characterisation of fruit softening (Benge et al., 2000).

The findings of the studies by White et al. (2005 and 2007) also suggested that the IEP model best characterised fruit softening in the later phase of softening and was not suitable in the early phase of softening prediction. The accuracy of the IEP model was also compared with that of the Boltzmann model. The IEP model appeared to fit the observed data significantly better than the Boltzmann model and IEP model was the only model to replicate all the phases of the fruit softening (Jordan & Loeffen, 2009; White et al., 2007; White, Silva et al., 2005). The results observed in this study were different to that observed in the above mentioned studies. When the IEP and Boltzmann models were compared, the latter model was a better fit to the firmness data collected along the three supply chains. A possible reason for the IEP model to be the third best even though it identified and characterised all the phases of fruit softening, was due to the limited data collected in this study.

The Inverse Exponential Polynomial model has the basic form of the Boltzmann model, but with a cubic function rather than a linear function of time in the exponent. The plateau in the IEP function is created by a small quirk in the mathematics that makes the sigmoid pause for a time on its downward path. Apparently, the mathematics is rather unstable and there is a possibility for this function to indicate a rise in the firmness again which is not expected to happen physiologically (Jordan & Loeffen, 2009). The IEP model indicated an increase in flesh firmness along Supply Chain 3, which showed that this model was not the best model for this type of data. Although the IEP model is considered to be one of the best empirical models in characterising the softening curves, the complexity of the model makes its purely mathematical without any relation between the model parameters and real world or even to consistent flesh firmness measures. The parameters that control one phase have an impact on other phases, and this is not accounted for in the IEP model. The parameters of the model have no obvious biological meaning (thresholds and transition time), and often are highly correlated to each other (Benge et al., 2000; Jordan & Loeffen, 2009). Therefore, these limitations indicate that the IEP model was least suitable for predicting the firmness loss along the supply chains.

The parameters of the models mentioned previously are empirical and not functions of underlying factors (like temperature) affecting the firmness, which limits the use for making predictions underlying varying conditions. There is a difficulty in modeling fruit across this discontinuity because analytical models tend to have fixed parameter values, which in reality should be changed by the new conditions. Therefore, reports have suggested that empirical models used, fit well to the firmness data but more mechanistic models are required for predicting the underlying phenomena of softening (Benge et al., 2000; Jordan & Loeffen, 2009). Therefore, further modeling of the firmness data was conducted in this study to understand the effects of core temperature (which is directly influenced by environmental temperature) on the flesh firmness.

Three non-linear regression models including the Reciprocal, Power and the Reciprocal Quadratic were fitted to the firmness data. Among the three models, the Reciprocal model best characterised the flesh firmness and core temperature data along the three supply chains, suggesting that the response was asymptotic. The second best model was the Power model which indicated a similar response. As the core temperatures increased the flesh firmness of the fruit decreased. The third best model was the Reciprocal Quadratic, which had a parabolic response.

The Reciprocal and Reciprocal Quadratic models have been widely used, especially in agricultural applications. These have been historically used to model the relationship between yield of the crop and spacing or density or planting (Westcott & Callan, 1990). The Reciprocal model has an asymptotic response, while the Reciprocal Quadratic has a parabolic response. An asymptotic response is observed where an increase in core temperature results in the approach of flesh firmness to a fixed value (FF=0). In a parabolic response, an increase in core temperature results in the approach of flesh firmness to an optimum value. The Power model involves raising one variable to the power of the independent variable, which provides convex curve in response (Westcott & Callan, 1990).

7.0 CONCLUSION

Flesh firmness (kgf), soluble solids content (%Brix) and core temperature (°C) of kiwifruit were measured along the three identified supply chains through three distributors in India. As the storage and transportation temperatures increased along the supply chains, the core temperatures of the fruit also increased proportionally. Increase in the core temperatures resulted in a significant ($P<0.05$) decrease in the flesh firmness of kiwifruit. Meanwhile, the soluble solids content increased significantly ($P<0.05$) in kiwifruit belonging to the selected grower lines along the three supply chains.

The flesh firmness of the kiwifruit belonging to the three grower lines decreased significantly along Supply Chain 1. At the end of eight days along this supply chain, the firmness of the fruit were below 1 kgf (recommended minimum export fruit firmness). A similar significant decrease in flesh firmness was also observed in the three grower lines along Supply Chain 3. The flesh firmness of the fruit were below 1 kgf within six days of storage and transportation along Supply Chain 3 and the firmness of the fruit reduced further along this supply chain. The fruit evaluated along Supply Chain 2 were firmer compared to the fruit from other supply chains. Even though the flesh firmness decreased had significantly ($P<0.05$) along Supply Chain 2, the firmness of the fruit were above the recommended minimum export firmness (1 kgf) at the end of seven days.

A significant increase in soluble solids content (SSC) of kiwifruit was observed along the three supply chains. The SSC increased significantly ($P<0.05$) within eight days of storage and transportation along Supply Chain 1, while a significant increase in SSC was observed within four days along Supply Chain 2. The soluble solids content increased significantly within five days of storage and transportation along Supply Chain 3 and a further increase was observed at the end of the supply chain.

Three firmness loss models including the Simple Exponential, Boltzmann and the Inverse Exponential Polynomial were fitted to the flesh firmness data of kiwifruit collected along the supply chains. The Akaike Information Criteria (AIC) test was conducted to determine the model that best characterised the firmness loss along the three supply chains. The model with the least AIC_c value and standard error was considered as the most suitable model to characterise the firmness loss. The Simple Exponential model with the least AIC_c value (-51.43) and standard error (0.224) best characterised the firmness loss data of kiwifruit collected along Supply Chain 1. The second best model that characterised the firmness loss along this supply chain was the Boltzmann with an AIC_c value of -50.65 and a standard error of 0.229. The third best model was the Inverse Exponential Polynomial with an AIC_c value of -43.52 and a standard error of 0.241.

A similar ranking was observed for the models fitted to the firmness loss data collected along Supply Chain 3. The Simple Exponential model had the least AIC_c value (-69.29±0.139) and was considered as the best model to characterise the firmness loss along Supply Chain 3. The Boltzmann model (-67.76±0.139) was the second best model followed by the Inverse Exponential Polynomial model (-60.49±0.150). Meanwhile, the Boltzmann model (-48.09±0.241) was the best model to characterise the firmness loss along Supply Chain 2 followed by the Inverse Exponential Polynomial model (-40.79±0.259). The Simple Exponential model had the highest AIC_c value (-36.60±0.347) when compared to the other two firmness loss models and, it was therefore suitable for the firmness data collected along Supply Chain 2.

Mathematical models were developed and validated to predict the storage potential of kiwifruit along the three supply chains. The three storage potential models developed to fit the flesh firmness and core temperature data were the Reciprocal, Power and the Reciprocal Quadratic models. Among the three models, the Reciprocal model best characterised the data on flesh firmness and core temperature collected along the supply chains and the Power model was the second best model that fitted the data. The Reciprocal Quadratic model was the least suitable model and therefore was not suitable for predicting the storage potential of kiwifruit.

In conclusion, the kiwifruit flesh firmness decreased while the SSC increased significantly along the three supply chains. The Simple Exponential model best characterised the firmness loss along Supply Chain 1 and 3, while Boltzmann model best characterised the firmness loss of kiwifruit along Supply Chain 2. The Reciprocal model was the best model used to predict the storage potential of kiwifruit.

8.0 RECOMMENDATIONS

Based on the results obtained in this study, the following recommendations are made for further research:

1. Firmness loss of 'Hayward' kiwifruit along different supply chains to other importing countries can be monitored and the mathematical models developed in this study can be used to determine the storage potential of fruit.

2. Data on firmness loss in 'Hort16A' kiwifruit (gold variety) can be collected along the identified supply chains in India and then develop mathematical models characterising the softening the fruit.

3. The respiration rate and ethylene production in kiwifruit can be monitored along the supply chains in India and mathematical models to predict the effect of these factors on firmness loss could be developed.

4. The storage potential models (Reciprocal and Power) developed in this study can be validated by fitting them to the data on flesh firmness and core temperature collected along different supply chains to other importing countries.

5. Data can be collected on the endogenous factors such as starch hydrolysis and pectin solubilisation and the effect of these on flesh firmness of kiwifruit during storage can be determined for which empirical models could be developed.

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APPENDICES

APPENDIX A

Appendix A: Raw data collected along the three Supply Chains

A1: Measurement of flesh firmness (FF), Soluble solids content (SSC) and Core temperature (CT) along Supply Chain 1

Table A1-1: Measurement of FF, SSC and CT of Grower line 71714 kiwifruit at Mumbai cool store (on arrival)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (09/07/11)									
Grower line 71714;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	4.5	3.9	4.2	2.041155	1.769001	1.905078	0.192442	2.1	11.5
2	3.5	4.6	4.05	1.587565	2.086514	1.83704	0.35281	2.1	11.1
3	3.6	3.8	3.7	1.632924	1.723642	1.678283	0.064147	2.2	11
4	4.6	4	4.3	2.086514	1.81436	1.950437	0.192442	2.1	10.3
5	4.8	4.8	4.8	2.177232	2.177232	2.177232	0	2.1	10.4
6	4	3.7	3.85	1.81436	1.678283	1.746322	0.096221	2.1	11
7	4.1	3.9	4	1.859719	1.769001	1.81436	0.064147	2.1	10.1
8	4.3	4.7	4.5	1.950437	2.131873	2.041155	0.128295	2.2	10.2
9	4.2	4.1	4.15	1.905078	1.859719	1.882399	0.032074	2.1	10.3
10	4.5	4.4	4.45	2.041155	1.995796	2.018476	0.032074	2.2	11.3
11	5	5.9	5.45	2.26795	2.676181	2.472066	0.288663	2.2	10.9
12	4.6	4.4	4.5	2.086514	1.995796	2.041155	0.064147	2.2	11.2
13	4.7	4.9	4.8	2.131873	2.222591	2.177232	0.064147	2.1	10.2
14	4.9	4.4	4.65	2.222591	1.995796	2.109194	0.160368	2.4	10.8
15	5.1	5.5	5.3	2.313309	2.494745	2.404027	0.128295	2.3	10.2
16	5.3	5	5.15	2.404027	2.26795	2.335989	0.096221	2.3	10.7
17	5.1	5	5.05	2.313309	2.26795	2.29063	0.032074	2.3	9.1
18	4.8	4.8	4.8	2.177232	2.177232	2.177232	0	2.5	10.5
19	4.8	4.2	4.5	2.177232	1.905078	2.041155	0.192442	2.5	11.9
20	4	4.3	4.15	1.81436	1.950437	1.882399	0.096221	2.6	11.2

Table A1-2: Measurement of FF, SSC and CT of Grower line 71714 kiwifruit at Mumbai cool store (on arrival)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (09/07/11)									
Grower line 74047;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	4	3.8	3.9	1.81436	1.723642	1.769001	0.064147	2.1	9.7
2	4.5	4.7	4.6	2.041155	2.131873	2.086514	0.064147	2	9.2
3	5.1	5.3	5.2	2.313309	2.404027	2.358668	0.064147	2.1	10.5
4	6.5	6.1	6.3	2.948335	2.766899	2.857617	0.128295	2.2	10.1
5	7	7	7	3.17513	3.17513	3.17513	0	2.2	10
6	6.1	5.8	5.95	2.766899	2.630822	2.698861	0.096221	2.3	11.2
7	6.1	6.3	6.2	2.766899	2.857617	2.812258	0.064147	2.3	10.2
8	5.7	5.8	5.75	2.585463	2.630822	2.608143	0.032074	2.3	10
9	4.1	4	4.05	1.859719	1.81436	1.83704	0.032074	2.1	10
10	4.8	4.9	4.85	2.177232	2.222591	2.199912	0.032074	2.4	9.2
11	5.1	5.3	5.2	2.313309	2.404027	2.358668	0.064147	2.4	9.5
12	5.5	5.7	5.6	2.494745	2.585463	2.540104	0.064147	2.6	11.3
13	5.5	5.7	5.6	2.494745	2.585463	2.540104	0.064147	2.6	10.5
14	3.8	3.7	3.75	1.723642	1.678283	1.700963	0.032074	2.5	10.6
15	4.1	4.5	4.3	1.859719	2.041155	1.950437	0.128295	2.6	8.8
16	4.3	4.4	4.35	1.950437	1.995796	1.973117	0.032074	2.5	8.5
17	4.6	4.5	4.55	2.086514	2.041155	2.063835	0.032074	2.6	9
18	5.4	5.5	5.45	2.449386	2.494745	2.472066	0.032074	2.6	10.3
19	4.4	4.3	4.35	1.995796	1.950437	1.973117	0.032074	2.7	10.8
20	4.6	4.9	4.75	2.086514	2.222591	2.154553	0.096221	2.7	10.6

Table A1-3: Measurement of FF, SSC and CT of Grower line 50657 kiwifruit at Mumbai cool store (on arrival)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (09/07/11)									
Grower line 50657;Container temperature 3.2°C									
	Flesh firmness							Core temperature	Brix
Fruit no.	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV	(°C)	(%)
1	5.2	5	5.1	2.358668	2.26795	2.313309	0.064147	1.6	10.3
2	4.5	4.3	4.4	2.041155	1.950437	1.995796	0.064147	1.5	10.3
3	4.5	4.5	4.5	2.041155	2.041155	2.041155	0	1.3	10
4	4	4.5	4.25	1.81436	2.041155	1.927758	0.160368	1.3	10.9
5	5.5	5	5.25	2.494745	2.26795	2.381348	0.160368	1.4	10
6	6	6	6	2.72154	2.72154	2.72154	0	1.5	8.8
7	7	6.5	6.75	3.17513	2.948335	3.061733	0.160368	1.4	10.2
8	7	7.5	7.25	3.17513	3.401925	3.288528	0.160368	1.4	10.2
9	7.5	7.5	7.5	3.401925	3.401925	3.401925	0	1.5	10.4
10	6.5	6.5	6.5	2.948335	2.948335	2.948335	0	1.5	10.5
11	6	6.1	6.05	2.72154	2.766899	2.74422	0.032074	1.5	9.8
12	5.6	5.1	5.35	2.540104	2.313309	2.426707	0.160368	1.6	10
13	5.7	5.9	5.8	2.585463	2.676181	2.630822	0.064147	1.6	11.1
14	7	6.9	6.95	3.17513	3.129771	3.152451	0.032074	1.5	11.2
15	5.4	5.6	5.5	2.449386	2.540104	2.494745	0.064147	1.6	11
16	8	8	8	3.62872	3.62872	3.62872	0	1.6	9.9
17	6.6	6.7	6.65	2.993694	3.039053	3.016374	0.032074	1.6	9.2
18	7.2	7.1	7.15	3.265848	3.220489	3.243169	0.032074	1.7	10.5
19	6.9	7	6.95	3.129771	3.17513	3.152451	0.032074	1.6	9.9
20	5.5	6.2	5.85	2.494745	2.812258	2.653502	0.224516	1.7	9.4

Table A1-4: Measurement of FF, SSC and CT of Grower line 71714 kiwifruit at Mumbai cool store (at departure)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (12/07/11)									
Grower line 71714;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	4	3.5	3.75	1.81436	1.587565	1.700963	0.160368	3.4	9.5
2	4.2	4.2	4.2	1.905078	1.905078	1.905078	0	3.3	9.7
3	5.1	5	5.05	2.313309	2.26795	2.29063	0.032074	3.2	11.5
4	4.5	4.9	4.7	2.041155	2.222591	2.131873	0.128295	3.5	9.3
5	5.2	4	4.6	2.358668	1.81436	2.086514	0.384884	3.5	12.1
6	4	3.5	3.75	1.81436	1.587565	1.700963	0.160368	3.5	9.2
7	3.5	3.4	3.45	1.587565	1.542206	1.564886	0.032074	3.6	11.1
8	3.5	3.5	3.5	1.587565	1.587565	1.587565	0	3.4	11.2
9	4.9	4	4.45	2.222591	1.81436	2.018476	0.288663	3.5	12
10	3.6	4	3.8	1.632924	1.81436	1.723642	0.128295	3.6	10.9
11	4.9	4.4	4.65	2.222591	1.995796	2.109194	0.160368	3.6	11.8
12	4	3.9	3.95	1.81436	1.769001	1.791681	0.032074	3.7	12.1
13	4.3	4.9	4.6	1.950437	2.222591	2.086514	0.192442	3.8	10.6
14	4.1	4.1	4.1	1.859719	1.859719	1.859719	0	4.2	12.2
15	5	4.6	4.8	2.26795	2.086514	2.177232	0.128295	4.1	11.1
16	4.9	4.3	4.6	2.222591	1.950437	2.086514	0.192442	4	10.4
17	5	4.5	4.75	2.26795	2.041155	2.154553	0.160368	4.1	10.8
18	5	5.1	5.05	2.26795	2.313309	2.29063	0.032074	4.6	9.7
19	4.7	4.8	4.75	2.131873	2.177232	2.154553	0.032074	4.9	12.3
20	4.1	3.7	3.9	1.859719	1.678283	1.769001	0.128295	5.1	11.7

Table A1-5: Measurement of FF, SSC and CT of Grower line 74047 kiwifruit at Mumbai cool store (at departure)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (12/07/11)									
Grower line 74047;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	5.5	5.6	5.55	2.494745	2.540104	2.517425	0.032074	4.7	11.7
2	5.1	4.8	4.95	2.313309	2.177232	2.245271	0.096221	4.6	9.8
3	5	4.9	4.95	2.26795	2.222591	2.245271	0.032074	4.6	11.6
4	4.6	4.3	4.45	2.086514	1.950437	2.018476	0.096221	4.7	12.4
5	3.6	3.7	3.65	1.632924	1.678283	1.655604	0.032074	4.8	9.5
6	3.3	3.4	3.35	1.496847	1.542206	1.519527	0.032074	4.8	10.7
7	3.7	3.5	3.6	1.678283	1.587565	1.632924	0.064147	4.7	9.8
8	4.1	3.9	4	1.859719	1.769001	1.81436	0.064147	5.1	11.3
9	4.5	4.7	4.6	2.041155	2.131873	2.086514	0.064147	5	11.4
10	4.2	3.9	4.05	1.905078	1.769001	1.83704	0.096221	5.1	11.1
11	4	3.9	3.95	1.81436	1.769001	1.791681	0.032074	4.9	9
12	3.9	3.8	3.85	1.769001	1.723642	1.746322	0.032074	5.2	8.9
13	3.6	3.8	3.7	1.632924	1.723642	1.678283	0.064147	5.2	11
14	4	4.2	4.1	1.81436	1.905078	1.859719	0.064147	5.3	10.6
15	4.5	4.3	4.4	2.041155	1.950437	1.995796	0.064147	5.6	11.3
16	5.4	5.3	5.35	2.449386	2.404027	2.426707	0.032074	5.7	9.6
17	4.8	4.7	4.75	2.177232	2.131873	2.154553	0.032074	5.9	10.7
18	5.5	5.4	5.45	2.494745	2.449386	2.472066	0.032074	6	11
19	5	4.9	4.95	2.26795	2.222591	2.245271	0.032074	6.4	9.6
20	5.1	4.6	4.85	2.313309	2.086514	2.199912	0.160368	6.8	10.7

Table A1-6: Measurement of FF, SSC and CT of Grower line 50657 kiwifruit at Mumbai cool store (at departure)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (12/07/11)									
Grower line 50657;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	6.1	6.8	6.45	2.766899	3.084412	2.925656	0.224516	2.5	10.9
2	5.8	5.9	5.85	2.630822	2.676181	2.653502	0.032074	2.5	9.6
3	4.8	5	4.9	2.177232	2.26795	2.222591	0.064147	2.6	8.9
4	5.4	5.3	5.35	2.449386	2.404027	2.426707	0.032074	2.6	11
5	5.3	5.7	5.5	2.404027	2.585463	2.494745	0.128295	2.4	8.9
6	5.7	5	5.35	2.585463	2.26795	2.426707	0.224516	2.7	12.4
7	5.1	5.4	5.25	2.313309	2.449386	2.381348	0.096221	2.7	10.5
8	5.4	5.7	5.55	2.449386	2.585463	2.517425	0.096221	2.6	11.5
9	5.4	5	5.2	2.449386	2.26795	2.358668	0.128295	2.8	10.1
10	5.1	4.9	5	2.313309	2.222591	2.26795	0.064147	2.7	11.2
11	5.3	5.4	5.35	2.404027	2.449386	2.426707	0.032074	2.8	10
12	5	4.7	4.85	2.26795	2.131873	2.199912	0.096221	2.9	9.9
13	4.3	5.6	4.95	1.950437	2.540104	2.245271	0.416958	2.8	10.2
14	5.8	5.2	5.5	2.630822	2.358668	2.494745	0.192442	2.9	10.1
15	5.3	5.4	5.35	2.404027	2.449386	2.426707	0.032074	3	10.6
16	5.7	5.9	5.8	2.585463	2.676181	2.630822	0.064147	3.1	9.5
17	6.1	6.3	6.2	2.766899	2.857617	2.812258	0.064147	2.9	10.1
18	6	5.9	5.95	2.72154	2.676181	2.698861	0.032074	3	11.3
19	5.8	5.6	5.7	2.630822	2.540104	2.585463	0.064147	3.1	9.6
20	5.4	5	5.2	2.449386	2.26795	2.358668	0.128295	3.1	11.4

Table A1-7: Measurement of FF, SSC and CT of Grower line 71714 kiwifruit at Delhi wholesale market (on arrival)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (17/07/11)									
Grower line 71714;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.2	1.9	2.05	0.997898	0.861821	0.92986	0.096221	20	12.1
2	1.5	1.6	1.55	0.680385	0.725744	0.703065	0.032074	21	11.3
3	2.3	1.8	2.05	1.043257	0.816462	0.92986	0.160368	16.7	10.8
4	1.7	1.3	1.5	0.771103	0.589667	0.680385	0.128295	16	10.3
5	1.9	1.7	1.8	0.861821	0.771103	0.816462	0.064147	18.9	12
6	2.1	2.2	2.15	0.952539	0.997898	0.975219	0.032074	17.6	11.2
7	2.3	2.2	2.25	1.043257	0.997898	1.020578	0.032074	17.3	12.4
8	2.1	1.5	1.8	0.952539	0.680385	0.816462	0.192442	19.4	11.9
9	2	2.2	2.1	0.90718	0.997898	0.952539	0.064147	20.3	11
10	1.7	1.8	1.75	0.771103	0.816462	0.793783	0.032074	20.1	9.9
11	2.2	2.2	2.2	0.997898	0.997898	0.997898	0	20.4	11.3
12	2.2	1.8	2	0.997898	0.816462	0.90718	0.128295	19.8	10.7
13	2.1	2.3	2.2	0.952539	1.043257	0.997898	0.064147	19.9	12
14	2.3	1.9	2.1	1.043257	0.861821	0.952539	0.128295	20.5	12.2
15	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	21.1	12.8
16	1.7	1.9	1.8	0.771103	0.861821	0.816462	0.064147	21.4	11.6
17	2.2	2.1	2.15	0.997898	0.952539	0.975219	0.032074	20.9	11.8
18	2.5	2	2.25	1.133975	0.90718	1.020578	0.160368	21.2	11.5
19	2	1.9	1.95	0.90718	0.861821	0.884501	0.032074	21.4	11.1
20	2	1.7	1.85	0.90718	0.771103	0.839142	0.096221	21.6	11

Table A1-8: Measurement of FF, SSC and CT of Grower line 74047 kiwifruit at Delhi wholesale market (on arrival)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (17/07/11)									
Grower line 74047;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.8	3.1	2.95	1.270052	1.406129	1.338091	0.096221	11.8	10.4
2	2.1	2.2	2.15	0.952539	0.997898	0.975219	0.032074	11.3	11.2
3	2.8	3.2	3	1.270052	1.451488	1.36077	0.128295	10.6	10.3
4	2.5	2	2.25	1.133975	0.90718	1.020578	0.160368	12.1	10.1
5	2.6	2.4	2.5	1.179334	1.088616	1.133975	0.064147	13.1	11.1
6	2.9	3.1	3	1.315411	1.406129	1.36077	0.064147	13.4	11
7	2.2	2	2.1	0.997898	0.90718	0.952539	0.064147	12.9	9.5
8	2.8	2.5	2.65	1.270052	1.133975	1.202014	0.096221	12.8	11.4
9	2.5	2.4	2.45	1.133975	1.088616	1.111296	0.032074	11.5	12
10	3.9	3.5	3.7	1.769001	1.587565	1.678283	0.128295	11.9	10.8
11	3.2	2.9	3.05	1.451488	1.315411	1.38345	0.096221	11.8	10.4
12	3	2.9	2.95	1.36077	1.315411	1.338091	0.032074	12.5	10.9
13	2.7	2.1	2.4	1.224693	0.952539	1.088616	0.192442	12.9	9.8
14	2.2	2	2.1	0.997898	0.90718	0.952539	0.064147	11.9	10
15	3	2.8	2.9	1.36077	1.270052	1.315411	0.064147	12.1	11
16	3.1	3.7	3.4	1.406129	1.678283	1.542206	0.192442	12.8	11.1
17	3	2.7	2.85	1.36077	1.224693	1.292732	0.096221	13	10.8
18	3.3	3.3	3.3	1.496847	1.496847	1.496847	0	13.2	11.5
19	3	3.2	3.1	1.36077	1.451488	1.406129	0.064147	13.5	11.7
20	2.1	1.8	1.95	0.952539	0.816462	0.884501	0.096221	13.4	10.4

Table A1-9: Measurement of FF, SSC and CT of Grower line 50657 kiwifruit at Delhi wholesale market (on arrival)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (17/07/11)									
Grower line 50657;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	3	3.1	3.05	1.36077	1.406129	1.38345	0.032074	12.1	9.3
2	3	3.1	3.05	1.36077	1.406129	1.38345	0.032074	11.9	9.7
3	2.9	2.5	2.7	1.315411	1.133975	1.224693	0.128295	11.6	12.9
4	3	3.1	3.05	1.36077	1.406129	1.38345	0.032074	11.8	11.2
5	4.1	3.9	4	1.859719	1.769001	1.81436	0.064147	12	11.8
6	3.4	3.5	3.45	1.542206	1.587565	1.564886	0.032074	12.1	11.6
7	3.3	3.4	3.35	1.496847	1.542206	1.519527	0.032074	12.4	11.2
8	3.6	2.9	3.25	1.632924	1.315411	1.474168	0.224516	12.3	10.3
9	3.6	3.8	3.7	1.632924	1.723642	1.678283	0.064147	12.2	10.3
10	2.6	2.7	2.65	1.179334	1.224693	1.202014	0.032074	11.9	12.6
11	3.5	3	3.25	1.587565	1.36077	1.474168	0.160368	12.1	11.7
12	1.2	1	1.1	0.544308	0.45359	0.498949	0.064147	12.8	10.8
13	3.6	3.5	3.55	1.632924	1.587565	1.610245	0.032074	12.5	12.1
14	3.5	3.7	3.6	1.587565	1.678283	1.632924	0.064147	12.6	9.7
15	3.3	3	3.15	1.496847	1.36077	1.428809	0.096221	12.5	12.5
16	3.4	3.5	3.45	1.542206	1.587565	1.564886	0.032074	12.4	10.6
17	3.1	3	3.05	1.406129	1.36077	1.38345	0.032074	12.1	12.4
18	2.9	2.7	2.8	1.315411	1.224693	1.270052	0.064147	12.2	12.5
19	3.4	3.3	3.35	1.542206	1.496847	1.519527	0.032074	12.4	11.2
20	2.8	2.9	2.85	1.270052	1.315411	1.292732	0.032074	12.5	10.5

Table A1-10: Measurement of FF, SSC and CT of Grower line 71714 kiwifruit at Delhi wholesale market (at departure)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (19/07/11)									
Grower line 71714;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	1.4	1.5	1.45	0.635026	0.680385	0.657706	0.032074	10.1	11
2	1.7	1.8	1.75	0.771103	0.816462	0.793783	0.032074	10.1	10.7
3	1.6	1.4	1.5	0.725744	0.635026	0.680385	0.064147	10.2	12.7
4	1.8	1.7	1.75	0.816462	0.771103	0.793783	0.032074	10.4	11.5
5	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	10.3	11.1
6	1.7	1.8	1.75	0.771103	0.816462	0.793783	0.032074	10.4	12.5
7	1.8	1.6	1.7	0.816462	0.725744	0.771103	0.064147	10.6	11.7
8	1.8	1.7	1.75	0.816462	0.771103	0.793783	0.032074	10.5	12.1
9	2	1.8	1.9	0.90718	0.816462	0.861821	0.064147	10.5	11.3
10	1	1	1	0.45359	0.45359	0.45359	0	10.8	11.8
11	1	1	1	0.45359	0.45359	0.45359	0	10.9	10.9
12	1	1	1	0.45359	0.45359	0.45359	0	10.8	12.8
13	1.6	1.7	1.65	0.725744	0.771103	0.748424	0.032074	12	10.5
14	1.3	1.5	1.4	0.589667	0.680385	0.635026	0.064147	11.7	11.3
15	1	1.1	1	0.45359	0.498949	0.45359	0.032074	12.5	11.5
16	1.6	1.5	1.55	0.725744	0.680385	0.703065	0.032074	13.1	11.1
17	1.6	1.4	1.5	0.725744	0.635026	0.680385	0.064147	13.7	11.3
18	1.5	1.3	1.4	0.680385	0.589667	0.635026	0.064147	12.8	11.3
19	1.8	1.4	1.6	0.816462	0.635026	0.725744	0.128295	12.9	12.3
20	1.4	1.5	1.45	0.635026	0.680385	0.657706	0.032074	14.1	10.9

Table A1-11: Measurement of FF, SSC and CT of Grower line 74047 kiwifruit at Delhi wholesale market (at departure)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (19/07/11)									
Grower line 74047;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.4	2.5	2.45	1.088616	1.133975	1.111296	0.032074	12.1	11.7
2	2.2	1.9	2.05	0.997898	0.861821	0.92986	0.096221	11.2	10
3	2.2	2.3	2.25	0.997898	1.043257	1.020578	0.032074	11.9	11.5
4	1.9	1.5	1.7	0.861821	0.680385	0.771103	0.128295	10.9	10.6
5	2.3	2	2.15	1.043257	0.90718	0.975219	0.096221	11.2	9.8
6	2.3	2.5	2.4	1.043257	1.133975	1.088616	0.064147	12.1	10.3
7	2.9	3.1	3	1.315411	1.406129	1.36077	0.064147	12.3	12
8	2.4	2.1	2.25	1.088616	0.952539	1.020578	0.096221	12.4	10.1
9	3	2.8	2.9	1.36077	1.270052	1.315411	0.064147	12.5	9.4
10	2.4	2	2.2	1.088616	0.90718	0.997898	0.128295	12.5	11.3
11	2.8	2.6	2.7	1.270052	1.179334	1.224693	0.064147	12.8	11.2
12	2.6	2.6	2.6	1.179334	1.179334	1.179334	0	12.6	12
13	2.3	2	2.15	1.043257	0.90718	0.975219	0.096221	12.7	10.5
14	2.2	2	2.1	0.997898	0.90718	0.952539	0.064147	11.9	10.1
15	2.3	2.6	2.45	1.043257	1.179334	1.111296	0.096221	11.6	11.3
16	1.6	1.7	1.65	0.725744	0.771103	0.748424	0.032074	11.7	9.7
17	1.8	1.7	1.75	0.816462	0.771103	0.793783	0.032074	12.3	11.5
18	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	12.8	12.4
19	2.6	2.5	2.55	1.179334	1.133975	1.156655	0.032074	12.9	10
20	1.9	1.8	1.85	0.861821	0.816462	0.839142	0.032074	12.7	10.2

Table A1-12: Measurement of FF, SSC and CT of Grower line 50657 kiwifruit at Delhi wholesale market (at departure)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (19/07/11)									
Grower line 560657;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.2	2	2.1	0.997898	0.90718	0.952539	0.064147	12.8	9.3
2	2.6	2.2	2.4	1.179334	0.997898	1.088616	0.128295	12.6	12.6
3	2.9	2.5	2.7	1.315411	1.133975	1.224693	0.128295	12.7	10.5
4	2.4	1.9	2.15	1.088616	0.861821	0.975219	0.160368	12.8	12.1
5	2.2	2.1	2.15	0.997898	0.952539	0.975219	0.032074	12.8	12.2
6	2.2	2.2	2.2	0.997898	0.997898	0.997898	0	12.9	10.4
7	2.4	2.5	2.45	1.088616	1.133975	1.111296	0.032074	13.1	10.5
8	2	2.1	2.05	0.90718	0.952539	0.92986	0.032074	13.5	12.1
9	2.2	2.1	2.15	0.997898	0.952539	0.975219	0.032074	13.4	12.4
10	2.2	2.1	2.15	0.997898	0.952539	0.975219	0.032074	13.7	11.6
11	2	1.8	1.9	0.90718	0.816462	0.861821	0.064147	13.7	11.1
12	1.6	2.1	1.85	0.725744	0.952539	0.839142	0.160368	13.6	10.9
13	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	13.8	10.9
14	2.2	2	2.1	0.997898	0.90718	0.952539	0.064147	13.9	9.9
15	2.5	2.4	2.45	1.133975	1.088616	1.111296	0.032074	13.9	9.8
16	1.4	1.6	1.5	0.635026	0.725744	0.680385	0.064147	13.8	10.5
17	2	1.9	1.95	0.90718	0.861821	0.884501	0.032074	14	11.3
18	2.2	1.9	2.05	0.997898	0.861821	0.92986	0.096221	13.7	10.1
19	2.3	2.5	2.4	1.043257	1.133975	1.088616	0.064147	13.9	10.9
20	2.3	2.6	2.45	1.043257	1.179334	1.111296	0.096221	13.9	11.5

Table A1-13: Measurement of FF, SSC and CT of Grower line 71714 kiwifruit at Delhi retail market (on arrival)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (20/07/11)									
Grower line 71714;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	1.6	1.7	1.65	0.725744	0.771103	0.748424	0.032074	11.8	12.1
2	1.6	1.7	1.65	0.725744	0.771103	0.748424	0.032074	10.7	11.9
3	1.5	1.6	1.55	0.680385	0.725744	0.703065	0.032074	10.9	11.6
4	1.3	1.5	1.4	0.589667	0.680385	0.635026	0.064147	12.6	12.4
5	1.5	1.3	1.4	0.680385	0.589667	0.635026	0.064147	11.4	12.6
6	1.6	1.4	1.5	0.725744	0.635026	0.680385	0.064147	11.6	12.1
7	1.2	1.2	1.2	0.544308	0.544308	0.544308	0	11.7	12.9
8	1.6	1.3	1.45	0.725744	0.589667	0.657706	0.096221	11.9	12.1
9	1.4	1.4	1.4	0.635026	0.635026	0.635026	0	10.9	11.5
10	1.6	1.7	1.65	0.725744	0.771103	0.748424	0.032074	11.1	12.6
11	1.3	1.5	1.4	0.589667	0.680385	0.635026	0.064147	11.6	10.7
12	1.7	1.6	1.65	0.771103	0.725744	0.748424	0.032074	11.8	11.4
13	1.3	1.1	1.2	0.589667	0.498949	0.544308	0.064147	12.5	11.5
14	1.5	1.7	1.6	0.680385	0.771103	0.725744	0.064147	12.2	11.4
15	1.6	1.6	1.6	0.725744	0.725744	0.725744	0	11.9	12.2
16	1.4	1.2	1.3	0.635026	0.544308	0.589667	0.064147	12.1	12.2
17	1.5	1.7	1.6	0.680385	0.771103	0.725744	0.064147	12.5	10.8
18	1.7	1.4	1.55	0.771103	0.635026	0.703065	0.096221	12.6	11.9
19	1.6	1.4	1.5	0.725744	0.635026	0.680385	0.064147	12.4	12
20	1.2	1.1	1.15	0.544308	0.498949	0.521629	0.032074	12.5	11.6

Table A1-14: Measurement of FF, SSC and CT of Grower line 74047 kiwifruit at Delhi retail market (on arrival)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (20/07/11)									
Grower line 74047;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.1	1.9	2	0.952539	0.861821	0.90718	0.064147	10.3	10.1
2	1.7	1.4	1.55	0.771103	0.635026	0.703065	0.096221	10.4	9.7
3	1.8	1.9	1.85	0.816462	0.861821	0.839142	0.032074	10.2	9.5
4	1.9	1.7	1.8	0.861821	0.771103	0.816462	0.064147	10.5	9.9
5	1.7	1.7	1.7	0.771103	0.771103	0.771103	0	10.3	9.5
6	1.7	1.9	1.8	0.771103	0.861821	0.816462	0.064147	10.6	10.4
7	1.6	1.7	1.65	0.725744	0.771103	0.748424	0.032074	10.4	9.8
8	1.8	1.6	1.7	0.816462	0.725744	0.771103	0.064147	10.5	9.3
9	1.8	1.8	1.8	0.816462	0.816462	0.816462	0	10.8	9.8
10	1.5	1.7	1.6	0.680385	0.771103	0.725744	0.064147	10.7	8.1
11	1.7	1.5	1.6	0.771103	0.680385	0.725744	0.064147	10.9	8.7
12	1.7	1.7	1.7	0.771103	0.771103	0.771103	0	11	10.4
13	2	1.9	1.95	0.90718	0.861821	0.884501	0.032074	10.9	10.5
14	1.9	1.9	1.9	0.861821	0.861821	0.861821	0	10.9	10.2
15	1.7	1.8	1.75	0.771103	0.816462	0.793783	0.032074	11.1	10.6
16	1.5	1.4	1.45	0.680385	0.635026	0.657706	0.032074	11.3	9.8
17	1.7	1.5	1.6	0.771103	0.680385	0.725744	0.064147	11.1	10.6
18	1.6	1.4	1.5	0.725744	0.635026	0.680385	0.064147	11.6	8.8
19	1.8	1.9	1.85	0.816462	0.861821	0.839142	0.032074	11.7	10.1
20	1.8	1.8	1.8	0.816462	0.816462	0.816462	0	11.6	9.9

Table A1-15: Measurement of FF, SSC and CT of Grower line 50657 kiwifruit at Delhi retail market (on arrival)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (20/07/11)									
Grower line 50657;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.2	2.2	2.2	0.997898	0.997898	0.997898	0	7.7	11.4
2	1.9	2	1.95	0.861821	0.90718	0.884501	0.032074	7.4	10.6
3	2.4	2.2	2.3	1.088616	0.997898	1.043257	0.064147	7.3	11.2
4	2.6	2.7	2.65	1.179334	1.224693	1.202014	0.032074	7.6	12.8
5	2	1.9	1.95	0.90718	0.861821	0.884501	0.032074	8.2	9.8
6	2.4	2.5	2.45	1.088616	1.133975	1.111296	0.032074	8	11.3
7	2.6	2.5	2.55	1.179334	1.133975	1.156655	0.032074	8.1	10.9
8	2.3	2.2	2.25	1.043257	0.997898	1.020578	0.032074	7.7	12.3
9	2.9	2.2	2.55	1.315411	0.997898	1.156655	0.224516	7.9	10.9
10	2.3	1.9	2.1	1.043257	0.861821	0.952539	0.128295	7.8	11.5
11	2.2	1.9	2.05	0.997898	0.861821	0.92986	0.096221	8	11
12	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	8.6	9.6
13	1.8	1.7	1.75	0.816462	0.771103	0.793783	0.032074	8.3	10.7
14	1.9	2	1.95	0.861821	0.90718	0.884501	0.032074	8.4	10.8
15	2.4	2.4	2.4	1.088616	1.088616	1.088616	0	8.2	12.1
16	1.9	1.8	1.85	0.861821	0.816462	0.839142	0.032074	8.2	11.2
17	1	1	1	0.45359	0.45359	0.45359	0	8.4	9.6
18	2	1.7	1.85	0.90718	0.771103	0.839142	0.096221	8.7	11.7
19	2	2.2	2.1	0.90718	0.997898	0.952539	0.064147	8.6	10.6
20	2.6	2.4	2.5	1.179334	1.088616	1.133975	0.064147	8.2	10.2

Table A1-16: Measurement of FF, SSC and CT of Grower line 71714 kiwifruit at Delhi retail market (at departure)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (21/07/11)									
Grower line 71714;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	1	1.1	1.05	0.45359	0.498949	0.47627	0.032074	19.3	9.2
2	1.2	1.2	1.2	0.544308	0.544308	0.544308	0	19.5	10.9
3	1.2	1.2	1.2	0.544308	0.544308	0.544308	0	19.6	10.1
4	1.3	1.1	1.2	0.589667	0.498949	0.544308	0.064147	19.6	11.1
5	1.5	1.3	1.4	0.680385	0.589667	0.635026	0.064147	19.5	12.7
6	1.4	1.3	1.35	0.635026	0.589667	0.612347	0.032074	19.7	11.9
7	1.1	1.3	1.2	0.498949	0.589667	0.544308	0.064147	19.7	11.4
8	1	1.1	1.05	0.45359	0.498949	0.47627	0.032074	19.7	11.3
9	1.2	1	1.1	0.544308	0.45359	0.498949	0.064147	19.8	10.8
10	1.3	1.2	1.25	0.589667	0.544308	0.566988	0.032074	19.9	12
11	1.2	1.2	1.2	0.544308	0.544308	0.544308	0	19.8	11.4
12	1	1.2	1.1	0.45359	0.544308	0.498949	0.064147	19.8	10.5
13	1.5	1.4	1.45	0.680385	0.635026	0.657706	0.032074	19.9	11.7
14	1.3	1.2	1.25	0.589667	0.544308	0.566988	0.032074	20	12.5
15	1.3	1.2	1.25	0.589667	0.544308	0.566988	0.032074	20.1	12.4
16	1	1	1	0.45359	0.45359	0.45359	0	20.1	11
17	1	1.1	1.05	0.45359	0.498949	0.47627	0.032074	20.2	11
18	1.1	1.2	1.15	0.498949	0.544308	0.521629	0.032074	20.1	11.5
19	1.4	1.2	1.3	0.635026	0.544308	0.589667	0.064147	20.3	11.6
20	1.2	1.2	1.2	0.544308	0.544308	0.544308	0	20.3	12

Table A1-17: Measurement of FF, SSC and CT of Grower line 74047 kiwifruit at Delhi retail market (at departure)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (21/07/11)									
Grower line 74047;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	1.8	1.7	1.75	0.816462	0.771103	0.793783	0.032074	20.1	11.5
2	1.3	1.2	1.25	0.589667	0.544308	0.566988	0.032074	20	11.9
3	1.4	1.4	1.4	0.635026	0.635026	0.635026	0	20.2	9.8
4	1.5	1.5	1.5	0.680385	0.680385	0.680385	0	20.1	11.4
5	1.8	2.1	1.95	0.816462	0.952539	0.884501	0.096221	20.2	11
6	1.7	1.6	1.65	0.771103	0.725744	0.748424	0.032074	20.2	11
7	1.4	1.3	1.35	0.635026	0.589667	0.612347	0.032074	20.3	10.2
8	1.9	1.8	1.85	0.861821	0.816462	0.839142	0.032074	20.5	10.8
9	1.6	1.7	1.65	0.725744	0.771103	0.748424	0.032074	20.4	11.6
10	1.3	1.3	1.3	0.589667	0.589667	0.589667	0	20.3	9.1
11	1	1	1	0.45359	0.45359	0.45359	0	20.6	9.5
12	1.6	1.4	1.5	0.725744	0.635026	0.680385	0.064147	20.6	10.9
13	1.7	1.5	1.6	0.771103	0.680385	0.725744	0.064147	20.5	11
14	1.7	1.7	1.7	0.771103	0.771103	0.771103	0	20.8	10
15	1.4	1.4	1.4	0.635026	0.635026	0.635026	0	20.7	10.6
16	1.6	1.7	1.65	0.725744	0.771103	0.748424	0.032074	20.7	10.8
17	1.3	1.1	1.2	0.589667	0.498949	0.544308	0.064147	20.8	11
18	1.2	1	1.1	0.544308	0.45359	0.498949	0.064147	20.9	9.7
19	1.4	1.2	1.3	0.635026	0.544308	0.589667	0.064147	20.8	11.2
20	1.5	1.5	1.5	0.680385	0.680385	0.680385	0	20.9	11.6

Table A1-18: Measurement of FF, SSC and CT of Grower line 50657 kiwifruit at Delhi retail market (at departure)

Supply chain 1: Suri Agro Distributor; Container MYRU 4504840 (21/07/11)									
Grower line 50657;Container temperature 3.2°C									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	1.4	1.5	1.45	0.635026	0.680385	0.657706	0.032074	20.6	12.3
2	1.5	1.4	1.45	0.680385	0.635026	0.657706	0.032074	20.7	12.3
3	1.4	1.2	1.3	0.635026	0.544308	0.589667	0.064147	20.7	12.4
4	1.5	1.4	1.45	0.680385	0.635026	0.657706	0.032074	20.8	12.5
5	1.4	1.4	1.4	0.635026	0.635026	0.635026	0	21	11
6	1.5	1.3	1.4	0.680385	0.589667	0.635026	0.064147	20.9	11.4
7	1.7	1.7	1.7	0.771103	0.771103	0.771103	0	21	12.5
8	1.3	1.6	1.45	0.589667	0.725744	0.657706	0.096221	21.2	10.7
9	1.5	1.4	1.45	0.680385	0.635026	0.657706	0.032074	21.2	11.2
10	1.1	1.2	1.15	0.498949	0.544308	0.521629	0.032074	21.1	11.9
11	2.1	1.8	1.95	0.952539	0.816462	0.884501	0.096221	21.4	10
12	1.7	1.7	1.7	0.771103	0.771103	0.771103	0	21.5	10.6
13	1	1.1	1.05	0.45359	0.498949	0.47627	0.032074	21.5	10.4
14	1.6	1.7	1.65	0.725744	0.771103	0.748424	0.032074	21.7	10.7
15	1.5	1.6	1.55	0.680385	0.725744	0.703065	0.032074	21.8	11.2
16	1.4	1.3	1.35	0.635026	0.589667	0.612347	0.032074	21.8	11.9
17	1.8	1.7	1.75	0.816462	0.771103	0.793783	0.032074	21.9	11.6
18	1.7	1.7	1.7	0.771103	0.771103	0.771103	0	21.8	11.8
19	1.4	1.5	1.45	0.635026	0.680385	0.657706	0.032074	21.9	11.8
20	1.7	1.8	1.75	0.771103	0.816462	0.793783	0.032074	22	11.1

A2: Measurement of flesh firmness (FF), Soluble solids content (SSC) and Core temperature (CT) along Supply Chain 2

Table A2-1: Measurement of FF, SSC and CT of Grower line 28724 kiwifruit at Mumbai cool store (on arrival)

Supply chain 2: IG International Distributor;									
Grower line 28724; Container MYRU 4514962 (27/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	6	6.4	6.2	2.72154	2.902976	2.812258	0.128295	2.7	7.5
2	6	6.3	6.15	2.72154	2.857617	2.789579	0.096221	2.6	9.3
3	5.9	5.8	5.85	2.676181	2.630822	2.653502	0.032074	2.5	9.3
4	5.7	5.5	5.6	2.585463	2.494745	2.540104	0.064147	2.8	9.8
5	5.8	5.8	5.8	2.630822	2.630822	2.630822	0	2.7	10.7
6	4.8	5	4.9	2.177232	2.26795	2.222591	0.064147	2.6	10.3
7	4.9	5.1	5	2.222591	2.313309	2.26795	0.064147	2.8	10.2
8	5.6	5.3	5.45	2.540104	2.404027	2.472066	0.096221	3.1	9.8
9	5.5	5.2	5.35	2.494745	2.358668	2.426707	0.096221	3	9.4
10	5.5	5.7	5.6	2.494745	2.585463	2.540104	0.064147	3.2	8.6
11	6.1	6.3	6.2	2.766899	2.857617	2.812258	0.064147	3.3	9.4
12	5.5	5.4	5.45	2.494745	2.449386	2.472066	0.032074	3.6	9.9
13	5.9	5.8	5.85	2.676181	2.630822	2.653502	0.032074	3.5	10.1
14	5.9	6.1	6	2.676181	2.766899	2.72154	0.064147	3.5	10
15	5.7	5.9	5.8	2.585463	2.676181	2.630822	0.064147	3.3	10.5
16	5.8	5.6	5.7	2.630822	2.540104	2.585463	0.064147	3.7	8.1
17	5.9	6.2	6.05	2.676181	2.812258	2.74422	0.096221	3.7	8.7
18	6.1	6.2	6.15	2.766899	2.812258	2.789579	0.032074	3.8	7.7
19	6.2	6.5	6.35	2.812258	2.948335	2.880297	0.096221	3.6	7.9
20	6.3	6.3	6.3	2.857617	2.857617	2.857617	0	3.7	9.5

Table A2-2: Measurement of FF, SSC and CT of Grower line 41503 kiwifruit at Mumbai cool store (on arrival)

Supply chain 2: IG International Distributor;									
Grower line 41503; Container MYRU 4514962 (27/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	6.1	6.4	6.25	2.766899	2.902976	2.834938	0.096221	1.8	9.4
2	8	8.5	8.25	3.62872	3.855515	3.742118	0.160368	1.9	11.6
3	6	5.8	5.9	2.72154	2.630822	2.676181	0.064147	1.8	12.1
4	5.3	5.2	5.25	2.404027	2.358668	2.381348	0.032074	2	12.3
5	4.7	4.5	4.6	2.131873	2.041155	2.086514	0.064147	2.1	10.9
6	6.1	6.3	6.2	2.766899	2.857617	2.812258	0.064147	2.5	11.4
7	4.9	5	4.95	2.222591	2.26795	2.245271	0.032074	2.4	11.6
8	6.3	5.9	6.1	2.857617	2.676181	2.766899	0.128295	2.6	9.1
9	7.8	8.1	7.95	3.538002	3.674079	3.606041	0.096221	2.7	8.9
10	7.4	8.1	7.75	3.356566	3.674079	3.515323	0.224516	3	9.3
11	6.5	6.9	6.7	2.948335	3.129771	3.039053	0.128295	2.9	10.1
12	6.2	6.5	6.35	2.812258	2.948335	2.880297	0.096221	2.8	10.5
13	7.1	6.8	6.95	3.220489	3.084412	3.152451	0.096221	3.1	11.3
14	5.3	5.5	5.4	2.404027	2.494745	2.449386	0.064147	2.8	10.7
15	5.9	5.8	5.85	2.676181	2.630822	2.653502	0.032074	2.9	12.1
16	8	8.3	8.15	3.62872	3.764797	3.696759	0.096221	3.1	10.6
17	7.5	7.1	7.3	3.401925	3.220489	3.311207	0.128295	3.1	11.7
18	6.7	6.5	6.6	3.039053	2.948335	2.993694	0.064147	3.2	11.2
19	6.8	7.1	6.95	3.084412	3.220489	3.152451	0.096221	3.2	9.7
20	5.9	5.6	5.75	2.676181	2.540104	2.608143	0.096221	3.2	10.4

Table A2-3: Measurement of FF, SSC and CT of Grower line 90603 kiwifruit at Mumbai cool store (on arrival)

Supply chain 2: IG International Distributor;									
Grower line 90603; Container MYRU 4514962 (27/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	5.8	6.1	5.95	2.630822	2.766899	2.698861	0.096221	2.7	9.2
2	6.8	7	6.9	3.084412	3.17513	3.129771	0.064147	2.6	9.3
3	8	7.6	7.8	3.62872	3.447284	3.538002	0.128295	2.8	9
4	5.9	5.7	5.8	2.676181	2.585463	2.630822	0.064147	2.8	9.7
5	4.6	4.9	4.75	2.086514	2.222591	2.154553	0.096221	2.9	8.4
6	8.5	9	8.75	3.855515	4.08231	3.968913	0.160368	3	8.8
7	8.2	7.9	8.05	3.719438	3.583361	3.6514	0.096221	3	9.2
8	9.2	9.5	9.35	4.173028	4.309105	4.241067	0.096221	3	8.3
9	8	8.2	8.1	3.62872	3.719438	3.674079	0.064147	3.1	8.1
10	5.1	5.7	5.4	2.313309	2.585463	2.449386	0.192442	3.2	7.9
11	5.9	5.8	5.85	2.676181	2.630822	2.653502	0.032074	3.3	10
12	6.6	6.6	6.6	2.993694	2.993694	2.993694	0	3.5	9.2
13	7.1	7.4	7.25	3.220489	3.356566	3.288528	0.096221	3.4	9.1
14	8.8	8.5	8.65	3.991592	3.855515	3.923554	0.096221	3.4	8.9
15	9.1	8.8	8.95	4.127669	3.991592	4.059631	0.096221	3.5	10.1
16	8.2	8.3	8.25	3.719438	3.764797	3.742118	0.032074	3.6	9.3
17	7.5	7.8	7.65	3.401925	3.538002	3.469964	0.096221	3.5	9.7
18	8.1	8.4	8.25	3.674079	3.810156	3.742118	0.096221	3.7	9
19	7.6	7.3	7.45	3.447284	3.311207	3.379246	0.096221	3.6	8.9
20	6.9	6.4	6.65	3.129771	2.902976	3.016374	0.160368	3.7	8.5

Table A2-4: Measurement of FF, SSC and CT of Grower line 28274 kiwifruit at Mumbai cool store (at departure)

Supply chain 2: IG International Distributor;									
Grower line 28724; Container MYRU 4514962 (30/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	5	4.9	4.95	2.26795	2.222591	2.245271	0.032074	4.6	11.5
2	5	5.2	5.1	2.26795	2.358668	2.313309	0.064147	4.4	10.3
3	5	5.2	5.1	2.26795	2.358668	2.313309	0.064147	4.4	11.5
4	5.5	5	5.25	2.494745	2.26795	2.381348	0.160368	4.4	11.4
5	5.1	5.5	5.3	2.313309	2.494745	2.404027	0.128295	4.5	8.3
6	5.1	5.3	5.2	2.313309	2.404027	2.358668	0.064147	4.5	9.9
7	4.8	4.9	4.85	2.177232	2.222591	2.199912	0.032074	4.6	10.2
8	5.2	5.3	5.25	2.358668	2.404027	2.381348	0.032074	4.7	10.6
9	5.5	5.6	5.55	2.494745	2.540104	2.517425	0.032074	4.7	9.3
10	5.2	4.9	5.05	2.358668	2.222591	2.29063	0.096221	4.5	10.7
11	5.2	5.1	5.15	2.358668	2.313309	2.335989	0.032074	4.6	10.1
12	5.4	5.3	5.35	2.449386	2.404027	2.426707	0.032074	4.6	11.3
13	4.5	4.6	4.55	2.041155	2.086514	2.063835	0.032074	4.7	11.1
14	4.9	4.8	4.85	2.222591	2.177232	2.199912	0.032074	4.7	10.9
15	5.1	5.1	5.1	2.313309	2.313309	2.313309	0	4.5	10.6
16	5.1	5.5	5.3	2.313309	2.494745	2.404027	0.128295	4.8	10.8
17	5.2	5.3	5.25	2.358668	2.404027	2.381348	0.032074	4.7	11.2
18	4.6	4.5	4.55	2.086514	2.041155	2.063835	0.032074	4.6	11.5
19	5.2	5.5	5.35	2.358668	2.494745	2.426707	0.096221	4.6	10.8
20	5.1	5.3	5.2	2.313309	2.404027	2.358668	0.064147	4.8	9.9

Table A2-5: Measurement of FF, SSC and CT of Grower line 41503 kiwifruit at Mumbai cool store (at departure)

Supply chain 2: IG International Distributor;									
Grower line 41503; Container MYRU 4514962 (30/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	7.6	7.5	7.55	3.447284	3.401925	3.424605	0.032074	4.3	11.5
2	7	7.2	7.1	3.17513	3.265848	3.220489	0.064147	4.4	12.2
3	7	6.6	6.8	3.17513	2.993694	3.084412	0.128295	4.4	11.5
4	6.6	6.9	6.75	2.993694	3.129771	3.061733	0.096221	4.3	11.4
5	6.7	6.2	6.45	3.039053	2.812258	2.925656	0.160368	4.6	10.7
6	7.6	7.6	7.6	3.447284	3.447284	3.447284	0	4.5	11.3
7	6.9	6.6	6.75	3.129771	2.993694	3.061733	0.096221	4.5	11
8	7.1	6.5	6.8	3.220489	2.948335	3.084412	0.192442	4.6	11
9	6.5	6.9	6.7	2.948335	3.129771	3.039053	0.128295	4.7	10.3
10	6.4	6.2	6.3	2.902976	2.812258	2.857617	0.064147	4.7	11
11	7.1	6.8	6.95	3.220489	3.084412	3.152451	0.096221	4.6	10.4
12	6.2	6.1	6.15	2.812258	2.766899	2.789579	0.032074	4.6	11.7
13	5.9	5.5	5.7	2.676181	2.494745	2.585463	0.128295	4.5	10.2
14	5.3	5.5	5.4	2.404027	2.494745	2.449386	0.064147	4.8	10.8
15	6.1	6.2	6.15	2.766899	2.812258	2.789579	0.032074	4.8	11.3
16	5.8	5.6	5.7	2.630822	2.540104	2.585463	0.064147	4.9	11.1
17	4.1	4.5	4.3	1.859719	2.041155	1.950437	0.128295	4.9	10.9
18	4.7	4.8	4.75	2.131873	2.177232	2.154553	0.032074	4.9	12.3
19	4.3	4.6	4.45	1.950437	2.086514	2.018476	0.096221	4.9	12.1
20	5.5	5.1	5.3	2.494745	2.313309	2.404027	0.128295	4.8	11.9

Table A2-6: Measurement of FF, SSC and CT of Grower line 90603 kiwifruit at Mumbai cool store (at departure)

Supply chain 2: IG International Distributor;									
Grower line 90603; Container MYRU 4514962 (30/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	6.5	6.5	6.5	2.948335	2.948335	2.948335	0	4.2	9
2	5.9	5.6	5.75	2.676181	2.540104	2.608143	0.096221	4.3	9.3
3	3.9	3.9	3.9	1.769001	1.769001	1.769001	0	4.3	9.2
4	5.9	6.1	6	2.676181	2.766899	2.72154	0.064147	4.5	7.6
5	3.8	4.1	3.95	1.723642	1.859719	1.791681	0.096221	4.4	9.5
6	6.5	6.4	6.45	2.948335	2.902976	2.925656	0.032074	4.4	9.9
7	6.5	6.3	6.4	2.948335	2.857617	2.902976	0.064147	4.4	8.6
8	8.1	8.2	8.15	3.674079	3.719438	3.696759	0.032074	4.5	8.8
9	7.5	8.2	7.85	3.401925	3.719438	3.560682	0.224516	4.5	8.5
10	6.3	5.5	5.9	2.857617	2.494745	2.676181	0.256589	4.7	7.9
11	8	7.9	7.95	3.62872	3.583361	3.606041	0.032074	4.5	9.3
12	6.9	7.3	7.1	3.129771	3.311207	3.220489	0.128295	4.6	9.6
13	7.1	7.4	7.25	3.220489	3.356566	3.288528	0.096221	4.6	8.9
14	8.3	7.9	8.1	3.764797	3.583361	3.674079	0.128295	4.7	8.2
15	7.5	7.5	7.5	3.401925	3.401925	3.401925	0	4.4	10.4
16	6.9	6.4	6.65	3.129771	2.902976	3.016374	0.160368	4.8	9.7
17	6.3	6.1	6.2	2.857617	2.766899	2.812258	0.064147	4.7	10.1
18	5.9	6.2	6.05	2.676181	2.812258	2.74422	0.096221	4.6	9.4
19	6.6	6.9	6.75	2.993694	3.129771	3.061733	0.096221	4.7	10
20	6.8	7.1	6.95	3.084412	3.220489	3.152451	0.096221	4.7	9.5

Table A2-7: Measurement of FF, SSC and CT of Grower line 28724 kiwifruit at Mumbai wholesale market (on arrival)

Supply chain 2: IG International Distributor;									
Grower line 28724; Container MYRU 4514962 (01/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	4.8	4.7	4.75	2.177232	2.131873	2.154553	0.032074	11.6	11.3
2	4.7	4.9	4.8	2.131873	2.222591	2.177232	0.064147	12.1	11.1
3	4.1	4.2	4.15	1.859719	1.905078	1.882399	0.032074	11.9	11.1
4	5.6	5.8	5.7	2.540104	2.630822	2.585463	0.064147	12.6	10
5	4.6	4.4	4.5	2.086514	1.995796	2.041155	0.064147	12.5	9.9
6	4.2	4.5	4.35	1.905078	2.041155	1.973117	0.096221	13.5	10.4
7	4.5	4.3	4.4	2.041155	1.950437	1.995796	0.064147	12.9	8.4
8	4.1	4.3	4.2	1.859719	1.950437	1.905078	0.064147	13.4	10
9	5.1	5.3	5.2	2.313309	2.404027	2.358668	0.064147	14.1	9.8
10	4.5	4.2	4.35	2.041155	1.905078	1.973117	0.096221	14.2	10.8
11	4.1	4.5	4.3	1.859719	2.041155	1.950437	0.128295	15.4	11.4
12	4.2	4.3	4.25	1.905078	1.950437	1.927758	0.032074	14.7	11.8
13	3.8	4.8	4.9	1.723642	2.177232	2.222591	0.320737	15.6	12.1
14	4.2	4.5	4.35	1.905078	2.041155	1.973117	0.096221	15.2	10.6
15	4.2	4.6	4.4	1.905078	2.086514	1.995796	0.128295	16.5	9.3
16	4.7	4.5	4.6	2.131873	2.041155	2.086514	0.064147	17.3	11.7
17	4.2	4.1	4.15	1.905078	1.859719	1.882399	0.032074	17.2	10.7
18	4.5	4.6	4.55	2.041155	2.086514	2.063835	0.032074	17.8	10.9
19	4.2	4	4.1	1.905078	1.81436	1.859719	0.064147	16.9	9.7
20	4.1	3.9	4	1.859719	1.769001	1.81436	0.064147	17.1	11.6

Table A2-8: Measurement of FF, SSC and CT of Grower line 41503 kiwifruit at Mumbai wholesale market (on arrival)

Supply chain 2: IG International Distributor;									
Grower line 41503; Container MYRU 4514962 (01/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	5.7	5.7	5.7	2.585463	2.585463	2.585463	0	20	11.2
2	4.5	4.6	4.55	2.041155	2.086514	2.063835	0.032074	20.2	10.5
3	6	5.6	5.8	2.72154	2.540104	2.630822	0.128295	20.1	9.2
4	5.6	5.5	5.55	2.540104	2.494745	2.517425	0.032074	20.4	9.3
5	5.4	5.3	5.35	2.449386	2.404027	2.426707	0.032074	20.4	10.3
6	8	7.5	7.75	3.62872	3.401925	3.515323	0.160368	20.9	9.6
7	5.2	4.8	5	2.358668	2.177232	2.26795	0.128295	20.7	11
8	6.5	6.9	6.7	2.948335	3.129771	3.039053	0.128295	21.1	12.2
9	7	6.4	6.7	3.17513	2.902976	3.039053	0.192442	21	11
10	4.3	4.9	4.6	1.950437	2.222591	2.086514	0.192442	21	11.8
11	5.2	5.6	5.4	2.358668	2.540104	2.449386	0.128295	21	12.1
12	6.1	5.8	5.95	2.766899	2.630822	2.698861	0.096221	21.3	12.2
13	4.9	4.8	4.85	2.222591	2.177232	2.199912	0.032074	21.7	11.7
14	5.2	5.4	5.3	2.358668	2.449386	2.404027	0.064147	21.9	10.5
15	5.6	5.6	5.6	2.540104	2.540104	2.540104	0	22.2	10.2
16	5.1	4.9	5	2.313309	2.222591	2.26795	0.064147	22.6	11.6
17	6.5	6.7	6.6	2.948335	3.039053	2.993694	0.064147	22.1	9.9
18	5.9	5.8	5.85	2.676181	2.630822	2.653502	0.032074	21.8	12.3
19	4.9	4.8	4.85	2.222591	2.177232	2.199912	0.032074	22.7	11.5
20	5.5	5.9	5.7	2.494745	2.676181	2.585463	0.128295	23.1	12.6

Table A2-9: Measurement of FF, SSC and CT of Grower line 90603 kiwifruit at Mumbai wholesale market (on arrival)

Supply chain 2: IG International Distributor;									
Grower line 90603; Container MYRU 4514962 (01/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	6.7	6.4	6.55	3.039053	2.902976	2.971015	0.096221	13.7	8.6
2	6.5	6.4	6.45	2.948335	2.902976	2.925656	0.032074	13.9	7.9
3	4.6	4.4	4.5	2.086514	1.995796	2.041155	0.064147	14.2	8.3
4	4.9	4.8	4.85	2.222591	2.177232	2.199912	0.032074	14.3	11.7
5	4.6	4.9	4.75	2.086514	2.222591	2.154553	0.096221	13.5	8.5
6	4.9	5.5	5.2	2.222591	2.494745	2.358668	0.192442	14	8.3
7	6.3	6.6	6.45	2.857617	2.993694	2.925656	0.096221	14.8	9
8	4.9	4.7	4.8	2.222591	2.131873	2.177232	0.064147	14.7	8.9
9	4.7	5.1	4.9	2.131873	2.313309	2.222591	0.128295	14.9	9.2
10	4.8	5.2	5	2.177232	2.358668	2.26795	0.128295	14.5	9.3
11	5.3	4.9	5.1	2.404027	2.222591	2.313309	0.128295	15.2	10
12	5.9	5.6	5.75	2.676181	2.540104	2.608143	0.096221	15	10.4
13	6.2	6.4	6.3	2.812258	2.902976	2.857617	0.064147	15.8	9.5
14	5.7	5.7	5.7	2.585463	2.585463	2.585463	0	15.9	10.7
15	5.9	5.3	5.6	2.676181	2.404027	2.540104	0.192442	16.5	11.3
16	6.2	5.9	6.05	2.812258	2.676181	2.74422	0.096221	16.8	10.5
17	6.2	5.8	6	2.812258	2.630822	2.72154	0.128295	17.7	9.8
18	6.6	6.5	6.55	2.993694	2.948335	2.971015	0.032074	18.9	9.3
19	5.8	5.7	5.75	2.630822	2.585463	2.608143	0.032074	18.6	8.5
20	5.4	5.7	5.55	2.449386	2.585463	2.517425	0.096221	19.3	8.8

Table A2-10: Measurement of FF, SSC and CT of Grower line 28724 kiwifruit at Mumbai wholesale market (at departure)

Supply chain 2: IG International Distributor;									
Grower line 28724; Container MYRU 4514962 (02/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	4.1	4.3	4.2	1.859719	1.950437	1.905078	0.064147	23.4	9.5
2	3.9	3.8	3.85	1.769001	1.723642	1.746322	0.032074	23.6	11.8
3	3.5	3.7	3.6	1.587565	1.678283	1.632924	0.064147	23.3	10.1
4	4.6	4.4	4.5	2.086514	1.995796	2.041155	0.064147	23.5	11.2
5	4.3	4.3	4.3	1.950437	1.950437	1.950437	0	23.5	10.5
6	3.6	3.9	3.75	1.632924	1.769001	1.700963	0.096221	23.6	10.6
7	4.2	4	4.1	1.905078	1.81436	1.859719	0.064147	23.7	11.7
8	4.4	4.5	4.45	1.995796	2.041155	2.018476	0.032074	23.8	9.9
9	4.7	4.4	4.55	2.131873	1.995796	2.063835	0.096221	23.7	10.7
10	4.8	4.6	4.7	2.177232	2.086514	2.131873	0.064147	23.7	10.5
11	4.3	4.6	4.45	1.950437	2.086514	2.018476	0.096221	23.5	10.3
12	4.4	4.2	4.3	1.995796	1.905078	1.950437	0.064147	23.6	11.1
13	3.7	3.8	3.75	1.678283	1.723642	1.700963	0.032074	23.6	10.9
14	4	3.8	3.9	1.81436	1.723642	1.769001	0.064147	23.7	10.7
15	4.1	3.9	4	1.859719	1.769001	1.81436	0.064147	23.9	9.8
16	4.2	4.6	4.4	1.905078	2.086514	1.995796	0.128295	23.8	11.6
17	4.7	4.8	4.75	2.131873	2.177232	2.154553	0.032074	23.9	10.1
18	4.5	4.8	4.65	2.041155	2.177232	2.109194	0.096221	23.7	10.5
19	4.6	4.2	4.4	2.086514	1.905078	1.995796	0.128295	23.8	11.3
20	4	4.3	4.15	1.81436	1.950437	1.882399	0.096221	23.6	11.4

Table A2-11: Measurement of FF, SSC and CT of Grower line 41503 kiwifruit at Mumbai wholesale market (at departure)

Supply chain 2: IG International Distributor;									
Grower line 41503; Container MYRU 4514962 (02/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	5.1	4.9	5	2.313309	2.222591	2.26795	0.064147	23.8	11.4
2	5.5	5.1	5.3	2.494745	2.313309	2.404027	0.128295	23.7	11.7
3	4.8	4.5	4.65	2.177232	2.041155	2.109194	0.096221	23.8	10.9
4	4.4	4.7	4.55	1.995796	2.131873	2.063835	0.096221	23.8	10.5
5	5	5.2	5.1	2.26795	2.358668	2.313309	0.064147	23.8	11.8
6	4.3	4.5	4.4	1.950437	2.041155	1.995796	0.064147	23.8	12.1
7	4.7	5	4.85	2.131873	2.26795	2.199912	0.096221	23.8	11.6
8	5.1	5.2	5.15	2.313309	2.358668	2.335989	0.032074	23.7	11
9	5.5	5.6	5.55	2.494745	2.540104	2.517425	0.032074	23.9	11.8
10	4.9	4.7	4.8	2.222591	2.131873	2.177232	0.064147	23.9	12
11	4.1	3.9	4	1.859719	1.769001	1.81436	0.064147	24.1	9.9
12	4.7	4.8	4.75	2.131873	2.177232	2.154553	0.032074	24.2	10.8
13	5.2	5.3	5.25	2.358668	2.404027	2.381348	0.032074	24.1	10.6
14	4.6	4.5	4.55	2.086514	2.041155	2.063835	0.032074	23.9	10.9
15	3.8	3.9	3.85	1.723642	1.769001	1.746322	0.032074	24	12.2
16	4.2	4.5	4.35	1.905078	2.041155	1.973117	0.096221	23.9	11.8
17	4.1	4.5	4.3	1.859719	2.041155	1.950437	0.128295	23.8	11.3
18	4.7	4.4	4.55	2.131873	1.995796	2.063835	0.096221	23.9	10.3
19	4.6	5	4.8	2.086514	2.26795	2.177232	0.128295	23.9	11.9
20	5.1	5.3	5.2	2.313309	2.404027	2.358668	0.064147	23.8	12.1

Table A2-12: Measurement of FF, SSC and CT of Grower line 90603 kiwifruit at Mumbai wholesale market (at departure)

Supply chain 2: IG International Distributor;									
Grower line 90603; Container MYRU 4514962 (02/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	4.9	4.8	4.85	2.222591	2.177232	2.199912	0.032074	23.5	10.1
2	5.1	5.5	5.3	2.313309	2.494745	2.404027	0.128295	23.3	10
3	5.4	5.6	5.5	2.449386	2.540104	2.494745	0.064147	23.2	10.8
4	4.9	4.6	4.75	2.222591	2.086514	2.154553	0.096221	23.4	10.4
5	4.4	4.3	4.35	1.995796	1.950437	1.973117	0.032074	23.4	11
6	5.1	5	5.05	2.313309	2.26795	2.29063	0.032074	23.5	12.1
7	5.3	5.4	5.35	2.404027	2.449386	2.426707	0.032074	23.5	10.5
8	4.8	4.7	4.75	2.177232	2.131873	2.154553	0.032074	23.5	9.7
9	4.5	4.7	4.6	2.041155	2.131873	2.086514	0.064147	23.5	9.4
10	4.3	4.6	4.45	1.950437	2.086514	2.018476	0.096221	23.4	10.4
11	5.2	5	5.1	2.358668	2.26795	2.313309	0.064147	23.7	10.2
12	5.5	5.6	5.55	2.494745	2.540104	2.517425	0.032074	23.7	9.6
13	5.3	5.5	5.4	2.404027	2.494745	2.449386	0.064147	23.6	10.3
14	4.9	4.5	4.7	2.222591	2.041155	2.131873	0.128295	23.6	10.9
15	4.6	4.2	4.4	2.086514	1.905078	1.995796	0.128295	23.8	11.1
16	5.2	5.5	5.35	2.358668	2.494745	2.426707	0.096221	23.9	9.8
17	4.2	4.5	4.35	1.905078	2.041155	1.973117	0.096221	23.6	10.7
18	4.4	4.7	4.55	1.995796	2.131873	2.063835	0.096221	23.8	11.3
19	5.2	5.4	5.3	2.358668	2.449386	2.404027	0.064147	23.9	10.9
20	4.3	4.1	4.2	1.950437	1.859719	1.905078	0.064147	23.8	10.4

Table A2-13: Measurement of FF, SSC and CT of Grower line 28724 kiwifruit at Mumbai retail market (on arrival)

Supply chain 2: IG International Distributor;									
Grower line 28724; Container MYRU 4514962 (01/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	4.1	4.5	4.3	1.859719	2.041155	1.950437	0.128295	2.4	9.8
2	4.2	4.5	4.35	1.905078	2.041155	1.973117	0.096221	2.7	11.1
3	4.9	4.6	4.75	2.222591	2.086514	2.154553	0.096221	2.5	9.7
4	4.5	4.8	4.65	2.041155	2.177232	2.109194	0.096221	2	9.5
5	4.1	4.2	4.15	1.859719	1.905078	1.882399	0.032074	2.1	8.5
6	4.3	4.5	4.4	1.950437	2.041155	1.995796	0.064147	2.5	9.5
7	4.2	4.4	4.3	1.905078	1.995796	1.950437	0.064147	2.3	10.5
8	4.5	4.6	4.55	2.041155	2.086514	2.063835	0.032074	2.3	10.2
9	4.7	4.8	4.75	2.131873	2.177232	2.154553	0.032074	2.4	10.5
10	5.2	5.5	5.35	2.358668	2.494745	2.426707	0.096221	2.2	10.3
11	4	4.3	4.15	1.81436	1.950437	1.882399	0.096221	2.1	9.9
12	5.1	5.1	5.1	2.313309	2.313309	2.313309	0	2.2	11.1
13	5	5	5	2.26795	2.26795	2.26795	0	2.2	11.4
14	5	4.8	4.9	2.26795	2.177232	2.222591	0.064147	2.5	10.2
15	4.9	5.1	5	2.222591	2.313309	2.26795	0.064147	2.7	10.1
16	4.8	4.5	4.65	2.177232	2.041155	2.109194	0.096221	2.7	11.5
17	4.7	4.4	4.55	2.131873	1.995796	2.063835	0.096221	2.8	11.4
18	4.5	4.6	4.55	2.041155	2.086514	2.063835	0.032074	2.6	10.9
19	5.4	5.1	5.25	2.449386	2.313309	2.381348	0.096221	2.6	10.6
20	4.6	4.9	4.75	2.086514	2.222591	2.154553	0.096221	2.8	11.5

Table A2-14: Measurement of FF, SSC and CT of Grower line 41503 kiwifruit at Mumbai retail market (on arrival)

Supply chain 2: IG International Distributor;									
Grower line 41503; Container MYRU 4514962 (01/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	5	5.5	5.25	2.26795	2.494745	2.381348	0.160368	1.4	10.5
2	5.5	5.5	5.5	2.494745	2.494745	2.494745	0	1.3	11.7
3	5.2	5.4	5.3	2.358668	2.449386	2.404027	0.064147	1.7	10.8
4	5.1	5.4	5.25	2.313309	2.449386	2.381348	0.096221	1.4	10.5
5	5.4	5.2	5.3	2.449386	2.358668	2.404027	0.064147	1.5	12.5
6	5.7	5.9	5.8	2.585463	2.676181	2.630822	0.064147	1.5	10.6
7	5.7	5.5	5.6	2.585463	2.494745	2.540104	0.064147	1.6	9.5
8	5.3	5	5.15	2.404027	2.26795	2.335989	0.096221	1.4	11.1
9	5.4	5.3	5.35	2.449386	2.404027	2.426707	0.032074	1.3	11.7
10	5.7	4.5	5.1	2.585463	2.041155	2.313309	0.384884	1.3	11.9
11	5.2	5.5	5.35	2.358668	2.494745	2.426707	0.096221	1.5	11.3
12	5.5	5.6	5.55	2.494745	2.540104	2.517425	0.032074	1.7	9.5
13	5.2	5	5.1	2.358668	2.26795	2.313309	0.064147	1.7	13.5
14	5.3	5.6	5.45	2.404027	2.540104	2.472066	0.096221	1.6	11.4
15	5.9	5.7	5.8	2.676181	2.585463	2.630822	0.064147	1.6	9.5
16	5.5	5.7	5.6	2.494745	2.585463	2.540104	0.064147	1.8	10.3
17	5.7	5.6	5.65	2.585463	2.540104	2.562784	0.032074	1.8	10.3
18	5	5.1	5.05	2.26795	2.313309	2.29063	0.032074	1.8	10.7
19	5.6	5.2	5.4	2.540104	2.358668	2.449386	0.128295	2	11.6
20	5.1	5.2	5.15	2.313309	2.358668	2.335989	0.032074	1.9	10.7

Table A2-15: Measurement of FF, SSC and CT of Grower line 90603 kiwifruit at Mumbai retail market (on arrival)

Supply chain 2: IG International Distributor;									
Grower line 90603; Container MYRU 4514962 (01/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	4.8	6	5.9	2.177232	2.72154	2.676181	0.384884	1.4	8.3
2	5.1	5.4	5.25	2.313309	2.449386	2.381348	0.096221	1.3	9.2
3	4.2	4.4	4.3	1.905078	1.995796	1.950437	0.064147	1.5	9.1
4	5.6	6	5.8	2.540104	2.72154	2.630822	0.128295	1.4	8.4
5	6.1	6.3	6.2	2.766899	2.857617	2.812258	0.064147	1.7	8.8
6	5	4.2	4.6	2.26795	1.905078	2.086514	0.256589	1.6	8.9
7	5.4	5.2	5.3	2.449386	2.358668	2.404027	0.064147	1.3	10.7
8	5.5	5.3	5.4	2.494745	2.404027	2.449386	0.064147	1.5	8.6
9	5.7	5.6	5.65	2.585463	2.540104	2.562784	0.032074	1.4	8.8
10	3.5	3.8	3.65	1.587565	1.723642	1.655604	0.096221	1.5	8.3
11	5.5	5.7	5.6	2.494745	2.585463	2.540104	0.064147	1.8	10.5
12	6.7	7	6.85	3.039053	3.17513	3.107092	0.096221	1.8	10
13	4.5	5	4.75	2.041155	2.26795	2.154553	0.160368	1.7	8
14	6	5.5	5.75	2.72154	2.494745	2.608143	0.160368	1.9	10.2
15	4.8	5.1	4.95	2.177232	2.313309	2.245271	0.096221	2.1	9.1
16	5.1	4.7	4.9	2.313309	2.131873	2.222591	0.128295	2.2	9.2
17	6	6.1	6.05	2.72154	2.766899	2.74422	0.032074	2.4	9.3
18	6.5	6.4	6.45	2.948335	2.902976	2.925656	0.032074	2.4	9.7
19	6.5	5.5	6	2.948335	2.494745	2.72154	0.320737	2.3	9.4
20	6.6	6.9	6.75	2.993694	3.129771	3.061733	0.096221	2.2	8.2

Table A2-16: Measurement of FF, SSC and CT of Grower line 28724 kiwifruit at Mumbai retail market (at departure)

Supply chain 2: IG International Distributor;									
Grower line 28724; Container MYRU 4514962 (04/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.7	2.8	2.75	1.224693	1.270052	1.247373	0.032074	26.7	9
2	2.2	2.5	2.35	0.997898	1.133975	1.065937	0.096221	26.9	8
3	2.3	2.4	2.35	1.043257	1.088616	1.065937	0.032074	27	10.3
4	2	1.9	1.95	0.90718	0.861821	0.884501	0.032074	26.8	11
5	1.9	2	1.95	0.861821	0.90718	0.884501	0.032074	26.8	10.7
6	2	2.2	2.1	0.90718	0.997898	0.952539	0.064147	27.2	10.2
7	1.9	1.8	1.85	0.861821	0.816462	0.839142	0.032074	27.3	9.6
8	2.3	2.5	2.4	1.043257	1.133975	1.088616	0.064147	27.2	9.2
9	2.6	2.4	2.5	1.179334	1.088616	1.133975	0.064147	27	11
10	2.1	1.9	2	0.952539	0.861821	0.90718	0.064147	27.1	10.4
11	2.5	2.3	2.4	1.133975	1.043257	1.088616	0.064147	27.3	9.2
12	2.4	2.3	2.35	1.088616	1.043257	1.065937	0.032074	27.3	10.7
13	3.1	2.9	3	1.406129	1.315411	1.36077	0.064147	27.4	10.3
14	2.5	2.4	2.45	1.133975	1.088616	1.111296	0.032074	27.4	9.4
15	2.3	2.4	2.35	1.043257	1.088616	1.065937	0.032074	27.4	9.5
16	1.9	1.8	1.85	0.861821	0.816462	0.839142	0.032074	27.3	8.9
17	2.6	2.6	2.6	1.179334	1.179334	1.179334	0	27.3	8.8
18	2.1	2.2	2.15	0.952539	0.997898	0.975219	0.032074	27.5	10.1
19	1.5	1.6	1.55	0.680385	0.725744	0.703065	0.032074	27.4	9.9
20	1.2	1.3	1.25	0.544308	0.589667	0.566988	0.032074	27.2	10.4

Table A2-17: Measurement of FF, SSC and CT of Grower line 41503 kiwifruit at Mumbai retail market (at departure)

Supply chain 2: IG International Distributor;									
Grower line 41503; Container MYRU 4514962 (04/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.2	2.2	2.2	0.997898	0.997898	0.997898	0	27.2	10.2
2	2.3	2.2	2.25	1.043257	0.997898	1.020578	0.032074	27.1	12
3	2.3	2.5	2.4	1.043257	1.133975	1.088616	0.064147	27.3	11.2
4	2.3	2.4	2.35	1.043257	1.088616	1.065937	0.032074	27.1	10.4
5	2.2	2.4	2.3	0.997898	1.088616	1.043257	0.064147	27.2	11.2
6	2.1	2.2	2.15	0.952539	0.997898	0.975219	0.032074	27.2	12.1
7	2.3	2.3	2.3	1.043257	1.043257	1.043257	0	27.5	12.6
8	2.4	2.5	2.45	1.088616	1.133975	1.111296	0.032074	27.4	12.2
9	3.1	3.2	3.15	1.406129	1.451488	1.428809	0.032074	27.5	11.5
10	2.5	2.5	2.5	1.133975	1.133975	1.133975	0	27.4	13.4
11	2.9	2.6	2.75	1.315411	1.179334	1.247373	0.096221	27.3	12.2
12	2.5	2.7	2.6	1.133975	1.224693	1.179334	0.064147	27.4	11.6
13	2.4	2.3	2.35	1.088616	1.043257	1.065937	0.032074	27.6	11.3
14	2.2	2.2	2.2	0.997898	0.997898	0.997898	0	27.5	11
15	2.4	2.5	2.45	1.088616	1.133975	1.111296	0.032074	27.5	10.5
16	2.6	2.6	2.6	1.179334	1.179334	1.179334	0	27.6	11.1
17	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	27.5	10.9
18	2.4	2.6	2.5	1.088616	1.179334	1.133975	0.064147	27.6	10.8
19	2.7	2.6	2.65	1.224693	1.179334	1.202014	0.032074	27.7	13.1
20	2.3	2.4	2.35	1.043257	1.088616	1.065937	0.032074	27.7	12.5

Table A2-18: Measurement of FF, SSC and CT of Grower line 90603 kiwifruit at Mumbai retail market (at departure)

Supply chain 2: IG International Distributor;									
Grower line 90603; Container MYRU 4514962 (04/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.4	2.7	2.55	1.088616	1.224693	1.156655	0.096221	26.8	9.8
2	2.8	2.9	2.85	1.270052	1.315411	1.292732	0.032074	26.8	8.9
3	2.5	2.7	2.6	1.133975	1.224693	1.179334	0.064147	26.5	9.7
4	2.5	2.6	2.55	1.133975	1.179334	1.156655	0.032074	26.4	9.5
5	2.4	2.5	2.45	1.088616	1.133975	1.111296	0.032074	26.4	8.8
6	2.4	2.3	2.35	1.088616	1.043257	1.065937	0.032074	26.5	9.2
7	2.2	2.4	2.3	0.997898	1.088616	1.043257	0.064147	26.7	9.1
8	2.2	2.1	2.15	0.997898	0.952539	0.975219	0.032074	26.7	8.9
9	2.2	2.2	2.2	0.997898	0.997898	0.997898	0	26.3	9
10	2.6	2.7	2.65	1.179334	1.224693	1.202014	0.032074	26.6	10
11	2.9	2.6	2.75	1.315411	1.179334	1.247373	0.096221	26.8	8.6
12	2.4	2.2	2.3	1.088616	0.997898	1.043257	0.064147	26.8	8.8
13	2.7	2.4	2.55	1.224693	1.088616	1.156655	0.096221	26.9	8.7
14	2.2	2.1	2.15	0.997898	0.952539	0.975219	0.032074	26.7	10.1
15	2.7	2.9	2.8	1.224693	1.315411	1.270052	0.064147	26.8	9
16	2.4	2.4	2.4	1.088616	1.088616	1.088616	0	26.5	10.3
17	2.7	2.6	2.65	1.224693	1.179334	1.202014	0.032074	26.9	9.5
18	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	26.9	9.2
19	2.2	2.5	2.35	0.997898	1.133975	1.065937	0.096221	26.8	8.6
20	2.1	2.2	2.15	0.952539	0.997898	0.975219	0.032074	26.9	8.9

A3: Measurement of flesh firmness (FF), Soluble solids content (SSC) and Core temperature (CT) along Supply Chain 3

Table A3-1: Measurement of FF, SSC and CT of Grower line 19583 kiwifruit at Mumbai cool store (on arrival)

Supply chain 3: DJ Distributor;									
Grower line 19583; Container MYRU (03/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	3.4	3.1	3.25	1.542206	1.406129	1.474168	0.096221	3	9
2	3.5	3.7	3.6	1.587565	1.678283	1.632924	0.064147	2.8	8.9
3	3	3.4	3.2	1.36077	1.542206	1.451488	0.128295	2.6	11.1
4	3.8	3.7	3.75	1.723642	1.678283	1.700963	0.032074	2.6	8.7
5	3.8	4	3.9	1.723642	1.81436	1.769001	0.064147	2.6	11.6
6	3.4	3.6	3.5	1.542206	1.632924	1.587565	0.064147	2.6	8.9
7	3.5	3.5	3.5	1.587565	1.587565	1.587565	0	2.6	10.1
8	3.8	3.5	3.65	1.723642	1.587565	1.655604	0.096221	2.7	10.9
9	3.6	3.3	3.45	1.632924	1.496847	1.564886	0.096221	2.7	9.6
10	3.7	3.5	3.6	1.678283	1.587565	1.632924	0.064147	2.8	11.4
11	3.1	3.5	3.3	1.406129	1.587565	1.496847	0.128295	2.7	8.7
12	3.2	3.6	3.4	1.451488	1.632924	1.542206	0.128295	2.8	9.5
13	3.6	3.2	3.4	1.632924	1.451488	1.542206	0.128295	2.9	12
14	3.5	3.4	3.45	1.587565	1.542206	1.564886	0.032074	2.9	9.2
15	3.6	3.2	3.4	1.632924	1.451488	1.542206	0.128295	2.9	11.1
16	3.2	3.1	3.15	1.451488	1.406129	1.428809	0.032074	2.9	10.7
17	3.5	3.2	3.35	1.587565	1.451488	1.519527	0.096221	2.9	11
18	3.5	3.4	3.45	1.587565	1.542206	1.564886	0.032074	3	9.5
19	3.8	3.9	3.85	1.723642	1.769001	1.746322	0.032074	3	10.9
20	3.9	4	3.95	1.769001	1.81436	1.791681	0.032074	3	10.9

Table A3-2: Measurement of FF, SSC and CT of Grower line 10122 kiwifruit at Mumbai cool store (on arrival)

Supply chain 3: DJ Distributor;									
Grower line 10122; Container MYRU (03/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	3.9	3.9	3.9	1.769001	1.769001	1.769001	0	1.6	8.8
2	3.8	3.9	3.85	1.723642	1.769001	1.746322	0.032074	1.7	9.9
3	3.5	3.4	3.45	1.587565	1.542206	1.564886	0.032074	1.7	8.8
4	3.9	4.1	4	1.769001	1.859719	1.81436	0.064147	1.7	10.2
5	3.7	3.5	3.6	1.678283	1.587565	1.632924	0.064147	1.6	10.3
6	3.6	3.9	3.75	1.632924	1.769001	1.700963	0.096221	1.6	11.1
7	3.5	3.5	3.5	1.587565	1.587565	1.587565	0	1.8	10
8	3.4	3.7	3.55	1.542206	1.678283	1.610245	0.096221	1.8	8.8
9	3.9	3.8	3.85	1.769001	1.723642	1.746322	0.032074	1.7	9.3
10	3.5	3.8	3.65	1.587565	1.723642	1.655604	0.096221	1.7	10.1
11	3.9	4.2	4.05	1.769001	1.905078	1.83704	0.096221	1.7	10.4
12	4.2	4.2	4.2	1.905078	1.905078	1.905078	0	1.8	10.1
13	3.9	4.3	4.1	1.769001	1.950437	1.859719	0.128295	1.8	10.7
14	3.1	3.1	3.1	1.406129	1.406129	1.406129	0	1.8	9.9
15	4	3.6	3.8	1.81436	1.632924	1.723642	0.128295	1.8	10.8
16	3.7	3.4	3.55	1.678283	1.542206	1.610245	0.096221	1.9	10.3
17	3.3	3.5	3.4	1.496847	1.587565	1.542206	0.064147	1.9	10.5
18	2.5	2.6	2.55	1.133975	1.179334	1.156655	0.032074	2	10.4
19	3.2	3.5	3.35	1.451488	1.587565	1.519527	0.096221	2.1	10.8
20	3.5	3.6	3.55	1.587565	1.632924	1.610245	0.032074	2.1	9.7

Table A3-3: Measurement of FF, SSC and CT of Grower line 13143 kiwifruit at Mumbai cool store (on arrival)

Supply chain 3: DJ Distributor;									
Grower line 13143; Container MYRU (03/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	3.5	3	3.25	1.587565	1.36077	1.474168	0.160368	1.6	10.8
2	3.6	3.8	3.7	1.632924	1.723642	1.678283	0.064147	1.5	10.1
3	3	3.5	3.25	1.36077	1.587565	1.474168	0.160368	0.6	10
4	3.8	3.4	3.6	1.723642	1.542206	1.632924	0.128295	1.6	10.6
5	2.8	3.1	2.95	1.270052	1.406129	1.338091	0.096221	1.7	10.8
6	3	3.5	3.25	1.36077	1.587565	1.474168	0.160368	1.6	10.7
7	3.1	3.4	3.25	1.406129	1.542206	1.474168	0.096221	1.6	10.4
8	3.5	3.8	3.65	1.587565	1.723642	1.655604	0.096221	1.7	11.3
9	3	3.3	3.15	1.36077	1.496847	1.428809	0.096221	1.7	10.5
10	2.7	2.7	2.7	1.224693	1.224693	1.224693	0	1.7	10.2
11	2.8	3.2	3	1.270052	1.451488	1.36077	0.128295	1.8	11.1
12	3	2.8	2.9	1.36077	1.270052	1.315411	0.064147	1.7	10.3
13	3.5	3.7	3.6	1.587565	1.678283	1.632924	0.064147	1.8	10.8
14	3.6	3.7	3.65	1.632924	1.678283	1.655604	0.032074	1.8	11.1
15	3.2	3.6	3.4	1.451488	1.632924	1.542206	0.128295	1.9	10.1
16	3.2	3	3.1	1.451488	1.36077	1.406129	0.064147	2	10.6
17	3.7	3.5	3.6	1.678283	1.587565	1.632924	0.064147	1.8	10.9
18	3	2.7	2.85	1.36077	1.224693	1.292732	0.096221	1.8	11.8
19	3.7	3.6	3.65	1.678283	1.632924	1.655604	0.032074	1.9	10
20	3.7	3.9	3.8	1.678283	1.769001	1.723642	0.064147	2	10.3

Table A3-4: Measurement of FF, SSC and CT of Grower line 19853 kiwifruit at Mumbai cool store (at departure)

Supply chain 3: DJ Distributor;									
Grower line 19583; Container MYRU (04/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	3.4	3.3	3.35	1.542206	1.496847	1.519527	0.032074	2.5	10.8
2	3.5	3	3.25	1.587565	1.36077	1.474168	0.160368	2.5	11.9
3	3.4	3.3	3.35	1.542206	1.496847	1.519527	0.032074	2.6	10.3
4	3.3	3.1	3.2	1.496847	1.406129	1.451488	0.064147	2.5	9.2
5	3.3	3.2	3.25	1.496847	1.451488	1.474168	0.032074	2.6	10.6
6	3.4	3.1	3.25	1.542206	1.406129	1.474168	0.096221	2.7	9.2
7	2.9	2.8	2.85	1.315411	1.270052	1.292732	0.032074	2.7	11
8	2.5	2.6	2.55	1.133975	1.179334	1.156655	0.032074	2.7	10.5
9	2.7	2.8	2.75	1.224693	1.270052	1.247373	0.032074	2.6	9.3
10	3	3.3	3.15	1.36077	1.496847	1.428809	0.096221	2.7	10.6
11	2.6	2.9	2.75	1.179334	1.315411	1.247373	0.096221	2.7	10.9
12	2.6	2.7	2.65	1.179334	1.224693	1.202014	0.032074	2.8	10.7
13	3.2	3.2	3.2	1.451488	1.451488	1.451488	0	2.7	9.8
14	3.4	3.5	3.45	1.542206	1.587565	1.564886	0.032074	2.8	9.2
15	3.3	3.3	3.3	1.496847	1.496847	1.496847	0	2.9	9.9
16	3.1	3	3.05	1.406129	1.36077	1.38345	0.032074	2.9	10.8
17	2.8	2.9	2.85	1.270052	1.315411	1.292732	0.032074	3.1	8.8
18	2.7	3.6	3.5	1.224693	1.632924	1.587565	0.288663	3	10.8
19	2.9	3.1	3	1.315411	1.406129	1.36077	0.064147	3.2	10.3
20	3.4	3.6	3.5	1.542206	1.632924	1.587565	0.064147	3.3	9.7

Table A3-5: Measurement of FF, SSC and CT of Grower line 10122 kiwifruit at Mumbai cool store (at departure)

Supply chain 3: DJ Distributor;									
Grower line 10122; Container MYRU (04/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	3.1	3.3	3.2	1.406129	1.496847	1.451488	0.064147	2	10.5
2	4.6	4.5	4.55	2.086514	2.041155	2.063835	0.032074	2.1	10.6
3	3.7	3.9	3.8	1.678283	1.769001	1.723642	0.064147	2.1	9.6
4	4.1	3.6	3.85	1.859719	1.632924	1.746322	0.160368	2	10.5
5	3.6	3.1	3.35	1.632924	1.406129	1.519527	0.160368	2.1	10.2
6	3.1	2.9	3	1.406129	1.315411	1.36077	0.064147	2.2	10.1
7	3.2	3.7	3.45	1.451488	1.678283	1.564886	0.160368	2.2	10.4
8	3.6	3.6	3.6	1.632924	1.632924	1.632924	0	2.3	10
9	3.7	3.9	3.8	1.678283	1.769001	1.723642	0.064147	2.3	9.9
10	3.5	3.4	3.45	1.587565	1.542206	1.564886	0.032074	2.3	9.4
11	4	3.7	3.85	1.81436	1.678283	1.746322	0.096221	2.3	9.3
12	3.4	3.5	3.45	1.542206	1.587565	1.564886	0.032074	2.4	10.5
13	4.3	4.6	4.45	1.950437	2.086514	2.018476	0.096221	2.4	10
14	4.2	4.2	4.2	1.905078	1.905078	1.905078	0	2.5	10.8
15	3.2	3.3	2.3	1.451488	1.496847	1.043257	0.032074	2.5	10.4
16	3.6	3.8	3.7	1.632924	1.723642	1.678283	0.064147	2.4	9.9
17	3.5	3.5	3.5	1.587565	1.587565	1.587565	0	2.4	10.2
18	3	2.6	2.8	1.36077	1.179334	1.270052	0.128295	2.4	9.4
19	3.6	3.8	3.7	1.632924	1.723642	1.678283	0.064147	2.4	10.1
20	3.3	3.5	3.4	1.496847	1.587565	1.542206	0.064147	2.4	10.8

Table A3-6: Measurement of FF, SSC and CT of Grower line 13143 kiwifruit at Mumbai cool store (at departure)

Supply chain 3: DJ Distributor;									
Grower line 13143; Container MYRU (04/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.5	2.1	2.3	1.133975	0.952539	1.043257	0.128295	2.6	10.9
2	3.5	3.3	3.4	1.587565	1.496847	1.542206	0.064147	2.5	11
3	3	3	3	1.36077	1.36077	1.36077	0	2.5	11.1
4	3.2	2.9	3.05	1.451488	1.315411	1.38345	0.096221	2.5	10.7
5	3.7	3.4	3.55	1.678283	1.542206	1.610245	0.096221	2.5	10.4
6	3.4	3.6	3.5	1.542206	1.632924	1.587565	0.064147	2.4	11.3
7	3.7	3.5	3.6	1.678283	1.587565	1.632924	0.064147	2.6	11.7
8	3	2.7	2.85	1.36077	1.224693	1.292732	0.096221	2.6	10.7
9	2.5	3	2.75	1.133975	1.36077	1.247373	0.160368	2.6	10.6
10	2.7	2.9	2.8	1.224693	1.315411	1.270052	0.064147	2.4	11.8
11	2.8	3.3	3.05	1.270052	1.496847	1.38345	0.160368	2.4	9.9
12	2.7	2.8	2.75	1.224693	1.270052	1.247373	0.032074	2.4	10.2
13	2.7	2.5	2.6	1.224693	1.133975	1.179334	0.064147	2.4	10.8
14	2.7	2.8	2.75	1.224693	1.270052	1.247373	0.032074	2.4	11
15	2.6	2.3	2.45	1.179334	1.043257	1.111296	0.096221	2.5	10.9
16	2.8	2.9	2.85	1.270052	1.315411	1.292732	0.032074	2.5	10.9
17	2.7	2.7	2.7	1.224693	1.224693	1.224693	0	2.4	10.6
18	2.8	2.4	2.6	1.270052	1.088616	1.179334	0.128295	2.4	10.2
19	3.1	3.3	3.2	1.406129	1.496847	1.451488	0.064147	2.5	10.6
20	3	2.8	2.9	1.36077	1.270052	1.315411	0.064147	2.5	10

Table A3-7: Measurement of FF, SSC and CT of Grower line 19563 kiwifruit at Bangalore wholesale market (on arrival)

Supply chain 3: DJ Distributor;									
Grower line 19583; Container MYRU (06/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.5	2.7	2.6	1.133975	1.224693	1.179334	0.064147	2.2	11
2	2.3	2.6	2.45	1.043257	1.179334	1.111296	0.096221	2.1	10.5
3	2.2	2.6	2.4	0.997898	1.179334	1.088616	0.128295	1.9	10.6
4	2.9	2.8	2.85	1.315411	1.270052	1.292732	0.032074	1.8	10.4
5	3	3.1	3.05	1.36077	1.406129	1.38345	0.032074	1.8	10.7
6	2.8	2.7	2.75	1.270052	1.224693	1.247373	0.032074	1.8	10.9
7	2.5	2.5	2.5	1.133975	1.133975	1.133975	0	1.8	10.8
8	2.1	2.3	2.2	0.952539	1.043257	0.997898	0.064147	1.9	10.8
9	2.6	2.4	2.5	1.179334	1.088616	1.133975	0.064147	1.8	10.6
10	2.6	2.8	2.7	1.179334	1.270052	1.224693	0.064147	1.8	11.1
11	3	2.7	2.85	1.36077	1.224693	1.292732	0.096221	2	11.4
12	2.4	2.4	2.4	1.088616	1.088616	1.088616	0	1.8	11.6
13	2.6	2.3	2.45	1.179334	1.043257	1.111296	0.096221	1.7	10.5
14	2.5	2.4	2.45	1.133975	1.088616	1.111296	0.032074	1.7	10.9
15	2.2	2.1	2.15	0.997898	0.952539	0.975219	0.032074	1.7	11.4
16	2.5	2.4	2.45	1.133975	1.088616	1.111296	0.032074	1.7	10.5
17	2.6	2.4	2.5	1.179334	1.088616	1.133975	0.064147	1.8	10.6
18	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	1.8	10.8
19	1.9	1.9	1.9	0.861821	0.861821	0.861821	0	1.9	10.7
20	2.6	2.7	2.65	1.179334	1.224693	1.202014	0.032074	1.8	10.8

Table A3-8: Measurement of FF, SSC and CT of Grower line 10122 kiwifruit at Bangalore wholesale market (on arrival)

Supply chain 3: DJ Distributor;									
Grower line 10122; Container MYRU (06/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	3.4	3.4	3.4	1.542206	1.542206	1.542206	0	1.9	10.7
2	3.1	3	3.05	1.406129	1.36077	1.38345	0.032074	1.9	10.7
3	2.9	2.8	2.85	1.315411	1.270052	1.292732	0.032074	1.9	10.5
4	3.5	3.3	3.4	1.587565	1.496847	1.542206	0.064147	2	10.8
5	2.8	2.9	2.85	1.270052	1.315411	1.292732	0.032074	2	10.8
6	3.3	3.3	3.3	1.496847	1.496847	1.496847	0	2	10.9
7	3.2	3.6	3.4	1.451488	1.632924	1.542206	0.128295	2	11.1
8	3.2	3	3.1	1.451488	1.36077	1.406129	0.064147	2	10.5
9	3.1	3.1	3.1	1.406129	1.406129	1.406129	0	2	10.4
10	3.4	3.2	3.3	1.542206	1.451488	1.496847	0.064147	2	10.7
11	2.7	2.9	2.8	1.224693	1.315411	1.270052	0.064147	2	10.4
12	3.1	3.3	3.2	1.406129	1.496847	1.451488	0.064147	2	10.8
13	3.2	3.2	3.2	1.451488	1.451488	1.451488	0	2	11
14	3.5	3.4	3.45	1.587565	1.542206	1.564886	0.032074	1.9	10.7
15	2.7	2.6	2.65	1.224693	1.179334	1.202014	0.032074	1.9	10.3
16	3.7	3.5	3.6	1.678283	1.587565	1.632924	0.064147	2	10.4
17	3.5	3.8	3.65	1.587565	1.723642	1.655604	0.096221	1.9	10.3
18	3.6	3.6	3.6	1.632924	1.632924	1.632924	0	1.9	10.2
19	3.4	3.2	3.3	1.542206	1.451488	1.496847	0.064147	1.9	10.2
20	2.9	3.2	3.05	1.315411	1.451488	1.38345	0.096221	1.9	10.1

Table A3-9: Measurement of FF, SSC and CT of Grower line 13143 kiwifruit at Bangalore wholesale market (on arrival)

Supply chain 3: DJ Distributor;									
Grower line 13143; Container MYRU (06/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.6	2.7	2.65	1.179334	1.224693	1.202014	0.032074	1.8	10.6
2	2.8	2.9	2.85	1.270052	1.315411	1.292732	0.032074	1.8	10.8
3	3.1	3	3.05	1.406129	1.36077	1.38345	0.032074	1.8	11
4	3	3	3	1.36077	1.36077	1.36077	0	2	10.5
5	2.5	2.6	2.55	1.133975	1.179334	1.156655	0.032074	1.9	11.1
6	2.5	2.4	2.45	1.133975	1.088616	1.111296	0.032074	1.9	10.7
7	2.3	2.5	2.4	1.043257	1.133975	1.088616	0.064147	1.9	10.7
8	2.7	2.8	2.75	1.224693	1.270052	1.247373	0.032074	1.9	10.4
9	3	3.2	3.1	1.36077	1.451488	1.406129	0.064147	1.9	10.8
10	2.8	2.8	2.8	1.270052	1.270052	1.270052	0	1.9	11.1
11	2.7	2.9	2.8	1.224693	1.315411	1.270052	0.064147	1.9	11.3
12	2.8	2.6	2.7	1.270052	1.179334	1.224693	0.064147	1.9	10.5
13	2.6	2.8	2.7	1.179334	1.270052	1.224693	0.064147	1.9	10.9
14	3.1	3	3.05	1.406129	1.36077	1.38345	0.032074	1.9	10.9
15	2.8	2.8	2.8	1.270052	1.270052	1.270052	0	1.9	10.5
16	2.5	2.7	2.6	1.133975	1.224693	1.179334	0.064147	1.9	11.5
17	2.7	2.4	2.55	1.224693	1.088616	1.156655	0.096221	1.9	11.4
18	2.5	2.7	2.6	1.133975	1.224693	1.179334	0.064147	1.9	11.4
19	2.4	2.6	2.5	1.088616	1.179334	1.133975	0.064147	1.9	11.3
20	2.3	2.3	2.3	1.043257	1.043257	1.043257	0	1.9	10.9

Table A3-10: Measurement of FF, SSC and CT of Grower line 19583 kiwifruit at Bangalore wholesale market (at departure)

Supply chain 3: DJ Distributor;									
Grower line 19583; Container MYRU (07/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.2	2.4	2.3	0.997898	1.088616	1.043257	0.064147	5.2	11.3
2	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	4.9	11.4
3	2.5	2.5	2.5	1.133975	1.133975	1.133975	0	5.5	11.2
4	2.7	2.6	2.65	1.224693	1.179334	1.202014	0.032074	5.3	10.9
5	2.6	2.6	2.6	1.179334	1.179334	1.179334	0	5.3	10.6
6	2.6	2.4	2.5	1.179334	1.088616	1.133975	0.064147	5.3	10.6
7	2.8	2.9	2.85	1.270052	1.315411	1.292732	0.032074	5.3	11.4
8	3	2.7	2.85	1.36077	1.224693	1.292732	0.096221	5.2	10.5
9	2.6	2.3	2.45	1.179334	1.043257	1.111296	0.096221	5.2	10.7
10	2.1	2.2	2.15	0.952539	0.997898	0.975219	0.032074	5.3	11.3
11	2.1	2.1	2.1	0.952539	0.952539	0.952539	0	5.3	10.4
12	2.3	2.3	2.3	1.043257	1.043257	1.043257	0	5.3	11.1
13	2.1	1.9	2	0.952539	0.861821	0.90718	0.064147	5.4	11.7
14	1.9	2.2	2.05	0.861821	0.997898	0.92986	0.096221	5.5	11.3
15	1.6	1.7	1.65	0.725744	0.771103	0.748424	0.032074	5.4	11.3
16	1.5	1.8	1.65	0.680385	0.816462	0.748424	0.096221	5.4	10.7
17	2.5	2.6	2.55	1.133975	1.179334	1.156655	0.032074	5.5	10.6
18	2.7	2.6	2.65	1.224693	1.179334	1.202014	0.032074	5.4	10.7
19	2.9	2.9	2.9	1.315411	1.315411	1.315411	0	5.3	10.8
20	2.1	2.4	2.25	0.952539	1.088616	1.020578	0.096221	5.3	11.5

Table A3-11: Measurement of FF, SSC and CT of Grower line 10122 kiwifruit at Bangalore wholesale market (at departure)

Supply chain 3: DJ Distributor;									
Grower line 10122; Container MYRU (07/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	3.1	2.9	3	1.406129	1.315411	1.36077	0.064147	4.8	11.5
2	2.9	2.9	2.9	1.315411	1.315411	1.315411	0	4.7	10.6
3	3.3	3.6	3.45	1.496847	1.632924	1.564886	0.096221	4.7	10.8
4	3.2	3.2	3.2	1.451488	1.451488	1.451488	0	4.7	10.8
5	3.4	3.3	3.35	1.542206	1.496847	1.519527	0.032074	4.7	11.1
6	3.6	3.3	3.45	1.632924	1.496847	1.564886	0.096221	4.7	11.6
7	3.2	3.1	3.15	1.451488	1.406129	1.428809	0.032074	4.7	11.6
8	3	3.3	3.15	1.36077	1.496847	1.428809	0.096221	4.7	10.9
9	3.5	3.6	3.55	1.587565	1.632924	1.610245	0.032074	4.7	10.5
10	2.9	2.6	2.75	1.315411	1.179334	1.247373	0.096221	4.7	10.3
11	2.7	2.9	2.8	1.224693	1.315411	1.270052	0.064147	4.7	10.9
12	3.1	3.4	3.25	1.406129	1.542206	1.474168	0.096221	4.7	11.4
13	3.3	3.5	3.4	1.496847	1.587565	1.542206	0.064147	4.7	10.4
14	2.9	2.8	2.85	1.315411	1.270052	1.292732	0.032074	4.7	10.5
15	2.4	2.7	2.55	1.088616	1.224693	1.156655	0.096221	4.7	10.3
16	3.5	3.2	3.35	1.587565	1.451488	1.519527	0.096221	4.8	10.7
17	3.4	3.4	3.4	1.542206	1.542206	1.542206	0	4.8	11.8
18	3.2	3.2	3.2	1.451488	1.451488	1.451488	0	4.8	11.5
19	3	3.1	3.05	1.36077	1.406129	1.38345	0.032074	4.8	11.3
20	3.4	3.4	3.4	1.542206	1.542206	1.542206	0	4.8	11.1

Table A3-12: Measurement of FF, SSC and CT of Grower line 13143 kiwifruit at Bangalore wholesale market (at departure)

Supply chain 3: DJ Distributor;									
Grower line 13143; Container MYRU (07/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.5	2.3	2.4	1.133975	1.043257	1.088616	0.064147	5.1	11.4
2	2.2	2.4	2.3	0.997898	1.088616	1.043257	0.064147	5.1	11.5
3	2.2	2.2	2.2	0.997898	0.997898	0.997898	0	5.1	10.5
4	2.6	2.6	2.6	1.179334	1.179334	1.179334	0	5.1	10.5
5	2.8	2.5	2.65	1.270052	1.133975	1.202014	0.096221	4.8	11.1
6	2.6	2.5	2.55	1.179334	1.133975	1.156655	0.032074	4.9	11
7	2.6	2.4	2.5	1.179334	1.088616	1.133975	0.064147	4.9	11.5
8	2.5	2.5	2.5	1.133975	1.133975	1.133975	0	4.9	11.5
9	2.7	2.6	2.65	1.224693	1.179334	1.202014	0.032074	4.9	11.4
10	2.6	2.6	2.6	1.179334	1.179334	1.179334	0	4.9	10.9
11	2.6	2.5	2.55	1.179334	1.133975	1.156655	0.032074	4.9	10.8
12	2.7	2.7	2.7	1.224693	1.224693	1.224693	0	4.9	10.7
13	2.3	2.2	2.25	1.043257	0.997898	1.020578	0.032074	4.9	11.1
14	2.6	2.4	2.5	1.179334	1.088616	1.133975	0.064147	4.9	11.5
15	2.6	2.6	2.6	1.179334	1.179334	1.179334	0	4.9	10.5
16	2.3	2.3	2.3	1.043257	1.043257	1.043257	0	4.9	10.6
17	2.2	2.4	2.3	0.997898	1.088616	1.043257	0.064147	4.9	10.6
18	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	4.9	10.7
19	2.2	2.4	2.3	0.997898	1.088616	1.043257	0.064147	4.9	11.3
20	2.3	2.4	2.35	1.043257	1.088616	1.065937	0.032074	4.9	11.2

Table A3-13: Measurement of FF, SSC and CT of Grower line 19583 kiwifruit at Bangalore retail market (on arrival)

Supply chain 3: DJ Distributor;									
Grower line 19583; Container MYRU (08/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.4	2.6	2.5	1.088616	1.179334	1.133975	0.064147	7.8	11.2
2	2.2	2.1	2.15	0.997898	0.952539	0.975219	0.032074	7.9	11.5
3	1.9	1.8	1.85	0.861821	0.816462	0.839142	0.032074	7.9	11.6
4	2.4	2.5	2.45	1.088616	1.133975	1.111296	0.032074	7.9	10.9
5	2.3	2.3	2.3	1.043257	1.043257	1.043257	0	7.9	10.6
6	2.3	2.1	2.2	1.043257	0.952539	0.997898	0.064147	8	11.6
7	2	2.1	2.05	0.90718	0.952539	0.92986	0.032074	8	11.7
8	2.5	2.7	2.6	1.133975	1.224693	1.179334	0.064147	8	11.4
9	2.4	2.5	2.45	1.088616	1.133975	1.111296	0.032074	8	11.3
10	2.5	2.5	2.5	1.133975	1.133975	1.133975	0	8	11
11	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	8	11
12	2.6	2.4	2.5	1.179334	1.088616	1.133975	0.064147	8	11.7
13	2.1	2.1	2.1	0.952539	0.952539	0.952539	0	8	11.8
14	1.9	1.7	1.8	0.861821	0.771103	0.816462	0.064147	8	11.2
15	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	8	10.9
16	1.7	1.8	1.75	0.771103	0.816462	0.793783	0.032074	8	10.8
17	1.9	2.1	2	0.861821	0.952539	0.90718	0.064147	8.1	11.3
18	1.8	1.8	1.8	0.816462	0.816462	0.816462	0	8.1	11.7
19	2.4	2.5	2.45	1.088616	1.133975	1.111296	0.032074	8.1	10.8
20	2.3	2.6	2.45	1.043257	1.179334	1.111296	0.096221	8.1	11.8

Table A3-14: Measurement of FF, SSC and CT of Grower line 10122 kiwifruit at Bangalore retail market (on arrival)

Supply chain 3: DJ Distributor;									
Grower line 10122; Container MYRU (08/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.4	2.5	2.45	1.088616	1.133975	1.111296	0.032074	8	11.3
2	2.7	2.7	2.7	1.224693	1.224693	1.224693	0	8	11.6
3	2.4	2.4	2.4	1.088616	1.088616	1.088616	0	8	11.4
4	2.6	2.7	2.65	1.179334	1.224693	1.202014	0.032074	8	11.2
5	2.8	2.9	2.85	1.270052	1.315411	1.292732	0.032074	8	11.6
6	2.3	2.5	2.4	1.043257	1.133975	1.088616	0.064147	8	11.5
7	2.6	2.6	2.6	1.179334	1.179334	1.179334	0	8	10.8
8	2.7	2.6	2.65	1.224693	1.179334	1.202014	0.032074	8	11.1
9	2.1	2.3	2.2	0.952539	1.043257	0.997898	0.064147	8	11.6
10	2.7	2.5	2.6	1.224693	1.133975	1.179334	0.064147	8.1	10.5
11	2.8	2.8	2.8	1.270052	1.270052	1.270052	0	8.1	10.8
12	2.6	2.7	2.65	1.179334	1.224693	1.202014	0.032074	8.1	11.4
13	2.5	2.5	2.5	1.133975	1.133975	1.133975	0	8.1	11.2
14	2.8	2.6	2.7	1.270052	1.179334	1.224693	0.064147	8.1	10.9
15	2.5	2.7	2.6	1.133975	1.224693	1.179334	0.064147	8.1	10.9
16	2.4	2.4	2.4	1.088616	1.088616	1.088616	0	8.1	11.5
17	2.8	2.6	2.7	1.270052	1.179334	1.224693	0.064147	8.1	10.9
18	2.3	2.2	2.25	1.043257	0.997898	1.020578	0.032074	8.1	11.2
19	2.1	2.1	2.1	0.952539	0.952539	0.952539	0	8.1	11.5
20	2.7	2.9	2.8	1.224693	1.315411	1.270052	0.064147	8.1	11.3

Table A3-15: Measurement of FF, SSC and CT of Grower line 13143 kiwifruit at Bangalore retail market (on arrival)

Supply chain 3: DJ Distributor;									
Grower line 13143; Container MYRU (08/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.1	2.4	2.25	0.952539	1.088616	1.020578	0.096221	8.1	11.5
2	2.1	2.1	2.1	0.952539	0.952539	0.952539	0	8.2	11.3
3	2.2	2	2.1	0.997898	0.90718	0.952539	0.064147	8.2	10.6
4	2.5	2.5	2.5	1.133975	1.133975	1.133975	0	8.1	10.7
5	2	2	2	0.90718	0.90718	0.90718	0	8.2	10.5
6	2.1	2.1	2.1	0.952539	0.952539	0.952539	0	8.2	11.4
7	2.5	2.4	2.45	1.133975	1.088616	1.111296	0.032074	8.2	11.2
8	2.4	2.3	2.35	1.088616	1.043257	1.065937	0.032074	8.2	11.4
9	2.6	2.4	2.5	1.179334	1.088616	1.133975	0.064147	8.2	10.8
10	2.2	2.3	2.25	0.997898	1.043257	1.020578	0.032074	8.2	11.3
11	2.1	2.1	2.1	0.952539	0.952539	0.952539	0	8.2	11.5
12	2.3	2.4	2.35	1.043257	1.088616	1.065937	0.032074	8.2	11.4
13	2.6	2.7	2.65	1.179334	1.224693	1.202014	0.032074	8.2	11.4
14	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	8.2	10.9
15	2.1	1.9	2	0.952539	0.861821	0.90718	0.064147	8.2	10.8
16	1.8	2.2	2	0.816462	0.997898	0.90718	0.128295	8.2	11.1
17	2.2	2.2	2.2	0.997898	0.997898	0.997898	0	8.2	11.7
18	2.3	2.4	2.35	1.043257	1.088616	1.065937	0.032074	8.2	11.8
19	2.3	2.2	2.25	1.043257	0.997898	1.020578	0.032074	8.2	11.3
20	2.5	2.3	2.4	1.133975	1.043257	1.088616	0.064147	8.3	10.6

Table A3-16: Measurement of FF, SSC and CT of Grower line 19583 kiwifruit at Bangalore retail market (at departure)

Supply chain 3: DJ Distributor;									
Grower line 19583; Container MYRU (13/08/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	1.5	1.5	1.5	0.68085	0.68085	0.680385	0	22.9	11.9
2	1.3	1.4	1.35	0.59007	0.63546	0.612347	0.032096	22.9	11.8
3	1	1	1	0.4539	0.4539	0.45359	0	22.9	12.4
4	1.4	1.3	1.35	0.63546	0.59007	0.612347	0.032096	22.9	12.6
5	1.5	1.3	1.4	0.68085	0.59007	0.635026	0.064191	22.9	13
6	1.2	1.1	1.15	0.54468	0.49929	0.521629	0.032096	22.9	12.5
7	1.1	1.1	1.1	0.49929	0.49929	0.498949	0	22.9	11.8
8	1.2	1.2	1.2	0.54468	0.54468	0.544308	0	22.9	11.4
9	1.6	1.5	1.55	0.72624	0.68085	0.703065	0.032096	22.9	11.8
10	1.6	1.4	1.5	0.72624	0.63546	0.680385	0.064191	22.9	12.4
11	1.3	1.3	1.3	0.59007	0.59007	0.589667	0	22.9	12
12	1.3	1.2	1.25	0.59007	0.54468	0.566988	0.032096	22.9	12.1
13	1	1.1	1.05	0.4539	0.49929	0.47627	0.032096	22.9	11.7
14	1.4	1.5	1.45	0.63546	0.68085	0.657706	0.032096	22.9	10.9
15	1.4	1.3	1.35	0.63546	0.59007	0.612347	0.032096	23	11.4
16	1.6	1.7	1.65	0.72624	0.77163	0.748424	0.032096	23	11.2
17	1	1.2	1.1	0.4539	0.54468	0.498949	0.064191	23	12.2
18	1.3	1.3	1.3	0.59007	0.59007	0.589667	0	23	12.1
19	1.2	1.4	1.3	0.54468	0.63546	0.589667	0.064191	23	11.4
20	1.1	1.4	1.25	0.49929	0.63546	0.566988	0.096287	23	11.8

Table A3-17: Measurement of FF, SSC and CT of Grower line 10122 kiwifruit at Bangalore retail market (at departure)

Supply chain 3: DJ Distributor;									
Grower line 10122; Container MYRU (13/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	2.1	2.1	2.1	0.952539	0.952539	0.952539	0	22.9	11.6
2	1.9	1.8	1.85	0.861821	0.816462	0.839142	0.032074	22.9	11.7
3	1.7	1.8	1.75	0.771103	0.816462	0.793783	0.032074	22.9	11.4
4	2	2	2	0.90718	0.90718	0.90718	0	22.9	12.1
5	1.9	1.6	1.75	0.861821	0.725744	0.793783	0.096221	22.9	12.5
6	2.4	2.2	2.3	1.088616	0.997898	1.043257	0.064147	23	12.7
7	2.5	2.4	2.45	1.133975	1.088616	1.111296	0.032074	22.9	12.3
8	2.3	2.3	2.3	1.043257	1.043257	1.043257	0	22.9	11.9
9	1.7	1.6	1.65	0.771103	0.725744	0.748424	0.032074	23	12.3
10	1.5	1.3	1.4	0.680385	0.589667	0.635026	0.064147	23	11.6
11	2.4	2.1	2.25	1.088616	0.952539	1.020578	0.096221	23	11.8
12	2.1	2.1	2.1	0.952539	0.952539	0.952539	0	23	12.1
13	1.9	2	1.95	0.861821	0.90718	0.884501	0.032074	23	12
14	1.7	1.9	1.8	0.771103	0.861821	0.816462	0.064147	23	11.9
15	2.3	2.2	2.25	1.043257	0.997898	1.020578	0.032074	23	12.4
16	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	23.1	12.5
17	1.9	2.2	2.05	0.861821	0.997898	0.92986	0.096221	23.1	12
18	2.4	2.3	2.35	1.088616	1.043257	1.065937	0.032074	23.1	11.5
19	2.2	2.2	2.2	0.997898	0.997898	0.997898	0	23.1	11.8
20	2.4	2.1	2.25	1.088616	0.952539	1.020578	0.096221	23.1	11.9

Table A3-18: Measurement of FF, SSC and CT of Grower line 13143 kiwifruit at Bangalore retail market (at departure)

Supply chain 3: DJ Distributor;									
Grower line 13143; Container MYRU (13/07/11)									
Fruit no.	Flesh firmness							Core temperature (°C)	Brix (%)
	P1 (lbf)	P2 (lbf)	Average (lbf)	P1 (kgf)	P2 (kgf)	Average (kgf)	STDV		
1	1.9	1.7	1.8	0.861821	0.771103	0.816462	0.064147	22.9	12.1
2	1.5	1.5	1.5	0.680385	0.680385	0.680385	0	22.9	12.5
3	1.4	1.6	1.5	0.635026	0.725744	0.680385	0.064147	22.9	11.8
4	1.6	1.8	1.7	0.725744	0.816462	0.771103	0.064147	22.9	11.6
5	2.1	2	2.05	0.952539	0.90718	0.92986	0.032074	22.9	11.5
6	2.1	2.1	2.1	0.952539	0.952539	0.952539	0	22.9	11.9
7	2	2.3	2.15	0.90718	1.043257	0.975219	0.096221	22.9	12.4
8	1.7	1.5	1.6	0.771103	0.680385	0.725744	0.064147	22.9	11.8
9	1.2	1.4	1.3	0.544308	0.635026	0.589667	0.064147	22.9	12.8
10	1.5	1.5	1.5	0.680385	0.680385	0.680385	0	22.9	13
11	1.6	1.8	1.7	0.725744	0.816462	0.771103	0.064147	22.9	12.4
12	1.9	2.1	2	0.861821	0.952539	0.90718	0.064147	22.9	11.4
13	2.2	2.6	2.4	0.997898	1.179334	1.088616	0.128295	22.9	11.5
14	2.3	2.4	2.35	1.043257	1.088616	1.065937	0.032074	22.9	11.8
15	2.5	2.6	2.55	1.133975	1.179334	1.156655	0.032074	22.9	12.1
16	1.6	1.8	1.7	0.725744	0.816462	0.771103	0.064147	22.9	11.3
17	1.8	1.9	1.85	0.816462	0.861821	0.839142	0.032074	22.9	11.7
18	1.6	1.9	1.75	0.725744	0.861821	0.793783	0.096221	23	12
19	2.1	2.2	2.15	0.952539	0.997898	0.975219	0.032074	23	12.1
20	2	2	2	0.90718	0.90718	0.90718	0	23	11.4

Appendix B: Temperature data collected along the supply chains retrieved from data loggers

B1: Temperature recordings along Supply Chain 1

Table B1: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
9/7/2011 21:11	1.875°C
9/7/2011 21:21	1.875°C
9/7/2011 21:31	1.875°C
9/7/2011 21:41	1.875°C
9/7/2011 21:51	1.875°C
9/7/2011 22:01	2°C
9/7/2011 22:11	2°C
9/7/2011 22:21	2.125°C
9/7/2011 22:31	2.125°C
9/7/2011 22:41	2.25°C
9/7/2011 22:51	2.25°C
9/7/2011 23:01	2.375°C
9/7/2011 23:11	2.375°C
9/7/2011 23:21	2.375°C
9/7/2011 23:31	2.5°C
9/7/2011 23:41	2.5°C
9/7/2011 23:51	2.625°C
10/7/2011 0:01	2.625°C
10/7/2011 0:11	2.75°C
10/7/2011 0:21	2.75°C
10/7/2011 0:31	2.875°C
10/7/2011 0:41	2.875°C
10/7/2011 0:51	3°C
10/7/2011 1:01	3°C
10/7/2011 1:11	3.125°C
10/7/2011 1:21	3.125°C
10/7/2011 1:31	3.25°C
10/7/2011 1:41	3.25°C
10/7/2011 1:51	3.375°C
10/7/2011 2:01	3.375°C
10/7/2011 2:11	3.5°C
10/7/2011 2:21	3.5°C
10/7/2011 2:31	3.5°C
10/7/2011 2:41	3.625°C
10/7/2011 2:51	3.625°C

Date	Temperature Reading
10/7/2011 3:01	3.75°C
10/7/2011 3:11	3.75°C
10/7/2011 3:21	3.875°C
10/7/2011 3:31	3.875°C
10/7/2011 3:41	3.875°C
10/7/2011 3:51	4°C
10/7/2011 4:01	4°C
10/7/2011 4:11	4°C
10/7/2011 4:21	4.125°C
10/7/2011 4:31	4.125°C
10/7/2011 4:41	4.25°C
10/7/2011 4:51	4.25°C
10/7/2011 5:01	4.25°C
10/7/2011 5:11	4.375°C
10/7/2011 5:21	4.375°C
10/7/2011 5:31	4.375°C
10/7/2011 5:41	4.5°C
10/7/2011 5:51	4.5°C
10/7/2011 6:01	4.5°C
10/7/2011 6:11	4.625°C
10/7/2011 6:21	4.625°C
10/7/2011 6:31	4.625°C
10/7/2011 6:41	4.75°C
10/7/2011 6:51	4.75°C
10/7/2011 7:01	4.75°C
10/7/2011 7:11	4.875°C
10/7/2011 7:21	4.875°C
10/7/2011 7:31	4.875°C
10/7/2011 7:41	4.875°C
10/7/2011 7:51	5°C
10/7/2011 8:01	5°C
10/7/2011 8:11	5°C
10/7/2011 8:21	5.125°C
10/7/2011 8:31	5.125°C
10/7/2011 8:41	5.125°C
10/7/2011 8:51	5.125°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading	Date	Temperature Reading
10/7/2011 9:01	5.125°C	10/7/2011 15:41	6.25°C
10/7/2011 9:11	5.25°C	10/7/2011 15:51	6.25°C
10/7/2011 9:21	5.25°C	10/7/2011 16:01	6.25°C
10/7/2011 9:31	5.25°C	10/7/2011 16:11	6.25°C
10/7/2011 9:41	5.25°C	10/7/2011 16:21	6.25°C
10/7/2011 9:51	5.375°C	10/7/2011 16:31	6.25°C
10/7/2011 10:01	5.375°C	10/7/2011 16:41	6.375°C
10/7/2011 10:11	5.375°C	10/7/2011 16:51	6.375°C
10/7/2011 10:21	5.375°C	10/7/2011 17:01	6.375°C
10/7/2011 10:31	5.5°C	10/7/2011 17:11	6.375°C
10/7/2011 10:41	5.5°C	10/7/2011 17:21	6.375°C
10/7/2011 10:51	5.5°C	10/7/2011 17:31	6.375°C
10/7/2011 11:01	5.5°C	10/7/2011 17:41	6.5°C
10/7/2011 11:11	5.5°C	10/7/2011 17:51	6.5°C
10/7/2011 11:21	5.625°C	10/7/2011 18:01	6.5°C
10/7/2011 11:31	5.625°C	10/7/2011 18:11	6.5°C
10/7/2011 11:41	5.625°C	10/7/2011 18:21	6.5°C
10/7/2011 11:51	5.625°C	10/7/2011 18:31	6.625°C
10/7/2011 12:01	5.625°C	10/7/2011 18:41	6.625°C
10/7/2011 12:11	5.75°C	10/7/2011 18:51	6.625°C
10/7/2011 12:21	5.75°C	10/7/2011 19:01	6.625°C
10/7/2011 12:31	5.75°C	10/7/2011 19:11	6.625°C
10/7/2011 12:41	5.75°C	10/7/2011 19:21	6.625°C
10/7/2011 12:51	5.75°C	10/7/2011 19:31	6.625°C
10/7/2011 13:01	5.875°C	10/7/2011 19:41	6.75°C
10/7/2011 13:11	5.875°C	10/7/2011 19:51	6.75°C
10/7/2011 13:21	5.875°C	10/7/2011 20:01	6.75°C
10/7/2011 13:31	5.875°C	10/7/2011 20:11	6.75°C
10/7/2011 13:41	5.875°C	10/7/2011 20:21	6.75°C
10/7/2011 13:51	6°C	10/7/2011 20:31	6.875°C
10/7/2011 14:01	6°C	10/7/2011 20:41	6.875°C
10/7/2011 14:11	6°C	10/7/2011 20:51	6.875°C
10/7/2011 14:21	6°C	10/7/2011 21:01	6.875°C
10/7/2011 14:31	6°C	10/7/2011 21:11	6.875°C
10/7/2011 14:41	6.125°C	10/7/2011 21:21	6.875°C
10/7/2011 14:51	6.125°C	10/7/2011 21:31	6.875°C
10/7/2011 15:01	6.125°C	10/7/2011 21:41	7°C
10/7/2011 15:11	6.125°C	10/7/2011 21:51	7°C
10/7/2011 15:21	6.125°C	10/7/2011 22:01	7°C
10/7/2011 15:31	6.125°C	10/7/2011 22:11	7°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
10/7/2011 22:21	7°C
10/7/2011 22:31	7°C
10/7/2011 22:41	7.125°C
10/7/2011 22:51	7.125°C
10/7/2011 23:01	7.125°C
10/7/2011 23:11	7.125°C
10/7/2011 23:21	7.125°C
10/7/2011 23:31	7.125°C
10/7/2011 23:41	7.125°C
10/7/2011 23:51	7.25°C
11/7/2011 0:01	7.25°C
11/7/2011 0:11	7.25°C
11/7/2011 0:21	7.25°C
11/7/2011 0:31	7.25°C
11/7/2011 0:41	7.25°C
11/7/2011 0:51	7.375°C
11/7/2011 1:01	7.375°C
11/7/2011 1:11	7.375°C
11/7/2011 1:21	7.375°C
11/7/2011 1:31	7.375°C
11/7/2011 1:41	7.375°C
11/7/2011 1:51	7.375°C
11/7/2011 2:01	7.5°C
11/7/2011 2:11	7.5°C
11/7/2011 2:21	7.5°C
11/7/2011 2:31	7.5°C
11/7/2011 2:41	7.5°C
11/7/2011 2:51	7.5°C
11/7/2011 3:01	7.5°C
11/7/2011 3:11	7.625°C
11/7/2011 3:21	7.625°C
11/7/2011 3:31	7.625°C
11/7/2011 3:41	7.625°C
11/7/2011 3:51	7.625°C
11/7/2011 4:01	7.625°C
11/7/2011 4:11	7.625°C
11/7/2011 4:21	7.75°C
11/7/2011 4:31	7.75°C
11/7/2011 4:41	7.75°C
11/7/2011 4:51	7.75°C

Date	Temperature Reading
11/7/2011 5:01	7.75°C
11/7/2011 5:11	7.75°C
11/7/2011 5:21	7.75°C
11/7/2011 5:31	7.875°C
11/7/2011 5:41	7.875°C
11/7/2011 5:51	7.875°C
11/7/2011 6:01	7.875°C
11/7/2011 6:11	7.875°C
11/7/2011 6:21	7.875°C
11/7/2011 6:31	7.875°C
11/7/2011 6:41	7.875°C
11/7/2011 6:51	8°C
11/7/2011 7:01	8°C
11/7/2011 7:11	8°C
11/7/2011 7:21	8°C
11/7/2011 7:31	8°C
11/7/2011 7:41	8°C
11/7/2011 7:51	8°C
11/7/2011 8:01	8°C
11/7/2011 8:11	8.125°C
11/7/2011 8:21	8.125°C
11/7/2011 8:31	8.125°C
11/7/2011 8:41	8.125°C
11/7/2011 8:51	8.125°C
11/7/2011 9:01	8.125°C
11/7/2011 9:11	8.125°C
11/7/2011 9:21	8.125°C
11/7/2011 9:31	8.25°C
11/7/2011 9:41	8.25°C
11/7/2011 9:51	8.25°C
11/7/2011 10:01	8.25°C
11/7/2011 10:11	8.25°C
11/7/2011 10:21	8.25°C
11/7/2011 10:31	8.25°C
11/7/2011 10:41	8.25°C
11/7/2011 10:51	8.25°C
11/7/2011 11:01	8.375°C
11/7/2011 11:11	8.375°C
11/7/2011 11:21	8.375°C
11/7/2011 11:31	8.375°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
11/7/2011 11:41	8.375°C
11/7/2011 11:51	8.375°C
11/7/2011 12:01	8.5°C
11/7/2011 12:11	8.5°C
11/7/2011 12:21	8.5°C
11/7/2011 12:31	8.5°C
11/7/2011 12:41	8.5°C
11/7/2011 12:51	8.625°C
11/7/2011 13:01	8.625°C
11/7/2011 13:11	8.625°C
11/7/2011 13:21	8.75°C
11/7/2011 13:31	8.75°C
11/7/2011 13:41	8.875°C
11/7/2011 13:51	8.875°C
11/7/2011 14:01	8.875°C
11/7/2011 14:11	9°C
11/7/2011 14:21	9°C
11/7/2011 14:31	9°C
11/7/2011 14:41	9.125°C
11/7/2011 14:51	9.125°C
11/7/2011 15:01	9.125°C
11/7/2011 15:11	9.25°C
11/7/2011 15:21	9.25°C
11/7/2011 15:31	9.25°C
11/7/2011 15:41	9.25°C
11/7/2011 15:51	9.25°C
11/7/2011 16:01	9.375°C
11/7/2011 16:11	9.375°C
11/7/2011 16:21	9.375°C
11/7/2011 16:31	9.375°C
11/7/2011 16:41	9.375°C
11/7/2011 16:51	9.375°C
11/7/2011 17:01	9.375°C
11/7/2011 17:11	9.375°C
11/7/2011 17:21	9.375°C
11/7/2011 17:31	9.375°C
11/7/2011 17:41	9.375°C
11/7/2011 17:51	9.375°C
11/7/2011 18:01	9.375°C
11/7/2011 18:11	9.375°C

Date	Temperature Reading
11/7/2011 18:21	9.25°C
11/7/2011 18:31	9.25°C
11/7/2011 18:41	9.25°C
11/7/2011 18:51	9.25°C
11/7/2011 19:01	9.25°C
11/7/2011 19:11	9.25°C
11/7/2011 19:21	9.25°C
11/7/2011 19:31	9.125°C
11/7/2011 19:41	9.125°C
11/7/2011 19:51	9.125°C
11/7/2011 20:01	9.125°C
11/7/2011 20:11	9.125°C
11/7/2011 20:21	9°C
11/7/2011 20:31	9°C
11/7/2011 20:41	9°C
11/7/2011 20:51	9°C
11/7/2011 21:01	8.875°C
11/7/2011 21:11	8.875°C
11/7/2011 21:21	8.875°C
11/7/2011 21:31	8.875°C
11/7/2011 21:41	8.75°C
11/7/2011 21:51	8.75°C
11/7/2011 22:01	8.75°C
11/7/2011 22:11	8.75°C
11/7/2011 22:21	8.625°C
11/7/2011 22:31	8.625°C
11/7/2011 22:41	8.625°C
11/7/2011 22:51	8.625°C
11/7/2011 23:01	8.5°C
11/7/2011 23:11	8.5°C
11/7/2011 23:21	8.5°C
11/7/2011 23:31	8.5°C
11/7/2011 23:41	8.375°C
11/7/2011 23:51	8.375°C
12/7/2011 0:01	8.375°C
12/7/2011 0:11	8.25°C
12/7/2011 0:21	8.25°C
12/7/2011 0:31	8.25°C
12/7/2011 0:41	8.25°C
12/7/2011 0:51	8.125°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
12/7/2011 1:01	8.125°C
12/7/2011 1:11	8.125°C
12/7/2011 1:21	8°C
12/7/2011 1:31	8°C
12/7/2011 1:41	8°C
12/7/2011 1:51	8°C
12/7/2011 2:01	7.875°C
12/7/2011 2:11	7.875°C
12/7/2011 2:21	7.875°C
12/7/2011 2:31	7.75°C
12/7/2011 2:41	7.75°C
12/7/2011 2:51	7.75°C
12/7/2011 3:01	7.75°C
12/7/2011 3:11	7.625°C
12/7/2011 3:21	7.625°C
12/7/2011 3:31	7.625°C
12/7/2011 3:41	7.5°C
12/7/2011 3:51	7.5°C
12/7/2011 4:01	7.5°C
12/7/2011 4:11	7.375°C
12/7/2011 4:21	7.375°C
12/7/2011 4:31	7.375°C
12/7/2011 4:41	7.375°C
12/7/2011 4:51	7.25°C
12/7/2011 5:01	7.25°C
12/7/2011 5:11	7.25°C
12/7/2011 5:21	7.125°C
12/7/2011 5:31	7.125°C
12/7/2011 5:41	7.125°C
12/7/2011 5:51	7.125°C
12/7/2011 6:01	7°C
12/7/2011 6:11	7°C
12/7/2011 6:21	7°C
12/7/2011 6:31	7°C
12/7/2011 6:41	6.875°C
12/7/2011 6:51	6.875°C
12/7/2011 7:01	6.875°C
12/7/2011 7:11	6.875°C
12/7/2011 7:21	6.75°C
12/7/2011 7:31	6.75°C
12/7/2011 7:41	6.75°C
12/7/2011 7:51	6.75°C
12/7/2011 8:01	6.625°C
12/7/2011 8:11	6.625°C
12/7/2011 8:21	6.625°C
12/7/2011 8:31	6.625°C
12/7/2011 8:41	6.5°C
12/7/2011 8:51	6.5°C
12/7/2011 9:01	6.5°C
12/7/2011 9:11	6.5°C
12/7/2011 9:21	6.5°C
12/7/2011 9:31	6.375°C
12/7/2011 9:41	6.375°C
12/7/2011 9:51	6.375°C
12/7/2011 10:01	6.375°C
12/7/2011 10:11	6.25°C
12/7/2011 10:21	6.25°C
12/7/2011 10:31	6.25°C
12/7/2011 10:41	6.25°C
12/7/2011 10:51	6.125°C
12/7/2011 11:01	6.125°C
12/7/2011 11:11	6.125°C
12/7/2011 11:21	6.125°C
12/7/2011 11:31	6°C
12/7/2011 11:41	6°C
12/7/2011 11:51	6°C
12/7/2011 12:01	6°C
12/7/2011 12:11	6°C
12/7/2011 12:21	5.875°C
12/7/2011 12:31	5.875°C
12/7/2011 12:41	5.875°C
12/7/2011 12:51	5.875°C
12/7/2011 13:01	5.875°C
12/7/2011 13:11	5.75°C
12/7/2011 13:21	5.75°C
12/7/2011 13:31	5.75°C
12/7/2011 13:41	5.75°C
12/7/2011 13:51	5.625°C
12/7/2011 14:01	5.625°C
12/7/2011 14:11	5.625°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
12/7/2011 14:21	5.625°C
12/7/2011 14:31	5.625°C
12/7/2011 14:41	5.5°C
12/7/2011 14:51	5.5°C
12/7/2011 15:01	5.5°C
12/7/2011 15:11	5.5°C
12/7/2011 15:21	5.5°C
12/7/2011 15:31	5.375°C
12/7/2011 15:41	5.375°C
12/7/2011 15:51	5.375°C
12/7/2011 16:01	5.375°C
12/7/2011 16:11	5.375°C
12/7/2011 16:21	5.25°C
12/7/2011 16:31	5.25°C
12/7/2011 16:41	5.25°C
12/7/2011 16:51	5.25°C
12/7/2011 17:01	5.25°C
12/7/2011 17:11	5.125°C
12/7/2011 17:21	5.125°C
12/7/2011 17:31	5.125°C
12/7/2011 17:41	5.125°C
12/7/2011 17:51	5.125°C
12/7/2011 18:01	5.125°C
12/7/2011 18:11	5°C
12/7/2011 18:21	5°C
12/7/2011 18:31	5°C
12/7/2011 18:41	5°C
12/7/2011 18:51	5°C
12/7/2011 19:01	4.875°C
12/7/2011 19:11	4.875°C
12/7/2011 19:21	4.875°C
12/7/2011 19:31	4.875°C
12/7/2011 19:41	4.875°C
12/7/2011 19:51	4.875°C
12/7/2011 20:01	4.75°C
12/7/2011 20:11	4.75°C
12/7/2011 20:21	4.75°C
12/7/2011 20:31	4.75°C
12/7/2011 20:41	4.75°C
12/7/2011 20:51	4.75°C

Date	Temperature Reading
12/7/2011 21:01	4.625°C
12/7/2011 21:11	4.625°C
12/7/2011 21:21	4.625°C
12/7/2011 21:31	4.625°C
12/7/2011 21:41	4.625°C
12/7/2011 21:51	4.625°C
12/7/2011 22:01	4.5°C
12/7/2011 22:11	4.5°C
12/7/2011 22:21	4.5°C
12/7/2011 22:31	4.5°C
12/7/2011 22:41	4.5°C
12/7/2011 22:51	4.5°C
12/7/2011 23:01	4.5°C
12/7/2011 23:11	4.375°C
12/7/2011 23:21	4.375°C
12/7/2011 23:31	4.375°C
12/7/2011 23:41	4.375°C
12/7/2011 23:51	4.375°C
13/07/11 00:01	4.375°C
13/07/11 00:11	4.375°C
13/07/11 00:21	4.375°C
13/07/11 00:31	4.25°C
13/07/11 00:41	4.25°C
13/07/11 00:51	4.25°C
13/07/11 01:01	4.25°C
13/07/11 01:11	4.25°C
13/07/11 01:21	4.25°C
13/07/11 01:31	4.25°C
13/07/11 01:41	4.25°C
13/07/11 01:51	4.125°C
13/07/11 02:01	4.125°C
13/07/11 02:11	4.125°C
13/07/11 02:21	4.125°C
13/07/11 02:31	4.125°C
13/07/11 02:41	4.125°C
13/07/11 02:51	4.125°C
13/07/11 03:01	4.125°C
13/07/11 03:11	4.125°C
13/07/11 03:21	4.125°C
13/07/11 03:31	4°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
13/07/11 03:41	4°C
13/07/11 03:51	4°C
13/07/11 04:01	4°C
13/07/11 04:11	4°C
13/07/11 04:21	4°C
13/07/11 04:31	4°C
13/07/11 04:41	4°C
13/07/11 04:51	4°C
13/07/11 05:01	4°C
13/07/11 05:11	3.875°C
13/07/11 05:21	3.875°C
13/07/11 05:31	3.875°C
13/07/11 05:41	3.875°C
13/07/11 05:51	3.875°C
13/07/11 06:01	3.875°C
13/07/11 06:11	3.875°C
13/07/11 06:21	3.875°C
13/07/11 06:31	3.875°C
13/07/11 06:41	3.875°C
13/07/11 06:51	3.875°C
13/07/11 07:01	3.75°C
13/07/11 07:11	3.75°C
13/07/11 07:21	3.75°C
13/07/11 07:31	3.75°C
13/07/11 07:41	3.75°C
13/07/11 07:51	3.75°C
13/07/11 08:01	3.75°C
13/07/11 08:11	3.75°C
13/07/11 08:21	3.75°C
13/07/11 08:31	3.75°C
13/07/11 08:41	3.75°C
13/07/11 08:51	3.75°C
13/07/11 09:01	3.75°C
13/07/11 09:11	3.75°C
13/07/11 09:21	3.75°C
13/07/11 09:31	3.75°C
13/07/11 09:41	3.625°C
13/07/11 09:51	3.625°C
13/07/11 10:01	3.625°C
13/07/11 10:11	3.625°C

Date	Temperature Reading
13/07/11 10:21	3.625°C
13/07/11 10:31	3.625°C
13/07/11 10:41	3.625°C
13/07/11 10:51	3.625°C
13/07/11 11:01	3.625°C
13/07/11 11:11	3.625°C
13/07/11 11:21	3.625°C
13/07/11 11:31	3.75°C
13/07/11 11:41	3.75°C
13/07/11 11:51	3.75°C
13/07/11 12:01	3.75°C
13/07/11 12:11	4.875°C
13/07/11 12:21	5.75°C
13/07/11 12:31	6°C
13/07/11 12:41	6.25°C
13/07/11 12:51	6.5°C
13/07/11 13:01	6.5°C
13/07/11 13:11	6.5°C
13/07/11 13:21	6.5°C
13/07/11 13:31	6.625°C
13/07/11 13:41	6.625°C
13/07/11 13:51	6.75°C
13/07/11 14:01	6.875°C
13/07/11 14:11	6.875°C
13/07/11 14:21	7°C
13/07/11 14:31	7°C
13/07/11 14:41	7.125°C
13/07/11 14:51	7.875°C
13/07/11 15:01	8.5°C
13/07/11 15:11	8.5°C
13/07/11 15:21	8.625°C
13/07/11 15:31	8.75°C
13/07/11 15:41	8.75°C
13/07/11 15:51	8.875°C
13/07/11 16:01	8.875°C
13/07/11 16:11	8.875°C
13/07/11 16:21	8.875°C
13/07/11 16:31	8.875°C
13/07/11 16:41	9°C
13/07/11 16:51	9°C

Table B1contd: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
13/07/11 17:01	9°C
13/07/11 17:11	9.125°C
13/07/11 17:21	9.125°C
13/07/11 17:31	9.125°C
13/07/11 17:41	9.125°C
13/07/11 17:51	9.125°C
13/07/11 18:01	9.125°C
13/07/11 18:11	9.125°C
13/07/11 18:21	9.25°C
13/07/11 18:31	9.25°C
13/07/11 18:41	9.25°C
13/07/11 18:51	9.25°C
13/07/11 19:01	9.25°C
13/07/11 19:11	9.25°C
13/07/11 19:21	9.25°C
13/07/11 19:31	9.25°C
13/07/11 19:41	9.25°C
13/07/11 19:51	9.25°C
13/07/11 20:01	9.25°C
13/07/11 20:11	9.25°C
13/07/11 20:21	9.25°C
13/07/11 20:31	9.25°C
13/07/11 20:41	9.25°C
13/07/11 20:51	9.25°C
13/07/11 21:01	9.25°C
13/07/11 21:11	9.25°C
13/07/11 21:21	9.375°C
13/07/11 21:31	9.375°C
13/07/11 21:41	9.375°C
13/07/11 21:51	9.375°C
13/07/11 22:01	9.375°C
13/07/11 22:11	9.375°C
13/07/11 22:21	9.25°C
13/07/11 22:31	9.375°C
13/07/11 22:41	9.25°C
13/07/11 22:51	9.25°C
13/07/11 23:01	9.25°C
13/07/11 23:11	9.25°C
13/07/11 23:21	9.25°C
13/07/11 23:31	9.25°C

Date	Temperature Reading
13/07/11 23:41	9.25°C
13/07/11 23:51	9.25°C
14/07/11 00:01	9.25°C
14/07/11 00:11	9.25°C
14/07/11 00:21	9.25°C
14/07/11 00:31	9.25°C
14/07/11 00:41	9.25°C
14/07/11 00:51	9.25°C
14/07/11 01:01	9.25°C
14/07/11 01:11	9.25°C
14/07/11 01:21	9.25°C
14/07/11 01:31	9.25°C
14/07/11 01:41	9.25°C
14/07/11 01:51	9.125°C
14/07/11 02:01	9.125°C
14/07/11 02:11	9.125°C
14/07/11 02:21	9.125°C
14/07/11 02:31	9.125°C
14/07/11 02:41	9.125°C
14/07/11 02:51	9.125°C
14/07/11 03:01	9.125°C
14/07/11 03:11	9.125°C
14/07/11 03:21	9.125°C
14/07/11 03:31	9.125°C
14/07/11 03:41	9.125°C
14/07/11 03:51	9.125°C
14/07/11 04:01	9.125°C
14/07/11 04:11	9.125°C
14/07/11 04:21	9.125°C
14/07/11 04:31	9.25°C
14/07/11 04:41	9.25°C
14/07/11 04:51	9.25°C
14/07/11 05:01	9.25°C
14/07/11 05:11	9.25°C
14/07/11 05:21	9.25°C
14/07/11 05:31	9.25°C
14/07/11 05:41	9.25°C
14/07/11 05:51	9.25°C
14/07/11 06:01	9.25°C
14/07/11 06:11	9.25°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
14/07/11 06:21	9.25°C
14/07/11 06:31	9.25°C
14/07/11 06:41	9.25°C
14/07/11 06:51	9.25°C
14/07/11 07:01	9.25°C
14/07/11 07:11	9.375°C
14/07/11 07:21	9.375°C
14/07/11 07:31	9.375°C
14/07/11 07:41	9.375°C
14/07/11 07:51	9.375°C
14/07/11 08:01	9.375°C
14/07/11 08:11	9.375°C
14/07/11 08:21	9.375°C
14/07/11 08:31	9.375°C
14/07/11 08:41	9.375°C
14/07/11 08:51	9.375°C
14/07/11 09:01	9.375°C
14/07/11 09:11	9.375°C
14/07/11 09:21	9.5°C
14/07/11 09:31	9.5°C
14/07/11 09:41	9.5°C
14/07/11 09:51	9.5°C
14/07/11 10:01	9.5°C
14/07/11 10:11	9.5°C
14/07/11 10:21	9.5°C
14/07/11 10:31	9.5°C
14/07/11 10:41	9.5°C
14/07/11 10:51	9.125°C
14/07/11 11:01	8.5°C
14/07/11 11:11	8.875°C
14/07/11 11:21	9°C
14/07/11 11:31	9°C
14/07/11 11:41	9°C
14/07/11 11:51	9.125°C
14/07/11 12:01	9.125°C
14/07/11 12:11	9.125°C
14/07/11 12:21	9.125°C
14/07/11 12:31	9.125°C
14/07/11 12:41	9.125°C
14/07/11 12:51	9.125°C

Date	Temperature Reading
14/07/11 13:01	9.125°C
14/07/11 13:11	9.25°C
14/07/11 13:21	9.25°C
14/07/11 13:31	9.25°C
14/07/11 13:41	9.25°C
14/07/11 13:51	9.25°C
14/07/11 14:01	9.375°C
14/07/11 14:11	9.375°C
14/07/11 14:21	9.375°C
14/07/11 14:31	9.375°C
14/07/11 14:41	9.375°C
14/07/11 14:51	9.375°C
14/07/11 15:01	9.5°C
14/07/11 15:11	9.5°C
14/07/11 15:21	9.5°C
14/07/11 15:31	9.5°C
14/07/11 15:41	9.625°C
14/07/11 15:51	9.625°C
14/07/11 16:01	9.625°C
14/07/11 16:11	9.625°C
14/07/11 16:21	9.75°C
14/07/11 16:31	9.75°C
14/07/11 16:41	9.75°C
14/07/11 16:51	9.875°C
14/07/11 17:01	9.875°C
14/07/11 17:11	9.875°C
14/07/11 17:21	9.875°C
14/07/11 17:31	10°C
14/07/11 17:41	10°C
14/07/11 17:51	10°C
14/07/11 18:01	10°C
14/07/11 18:11	10.125°C
14/07/11 18:21	10.125°C
14/07/11 18:31	10.125°C
14/07/11 18:41	10.125°C
14/07/11 18:51	10.125°C
14/07/11 19:01	10.25°C
14/07/11 19:11	10.25°C
14/07/11 19:21	10.25°C
14/07/11 19:31	10.25°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
14/07/11 19:41	10.375°C
14/07/11 19:51	10.375°C
14/07/11 20:01	10.375°C
14/07/11 20:11	10.375°C
14/07/11 20:21	10.375°C
14/07/11 20:31	10.375°C
14/07/11 20:41	10.375°C
14/07/11 20:51	10.5°C
14/07/11 21:01	10.5°C
14/07/11 21:11	10.5°C
14/07/11 21:21	10.5°C
14/07/11 21:31	10.5°C
14/07/11 21:41	10.5°C
14/07/11 21:51	10.5°C
14/07/11 22:01	10.5°C
14/07/11 22:11	10.5°C
14/07/11 22:21	10.625°C
14/07/11 22:31	10.625°C
14/07/11 22:41	10.625°C
14/07/11 22:51	10.625°C
14/07/11 23:01	10.625°C
14/07/11 23:11	10.625°C
14/07/11 23:21	10.625°C
14/07/11 23:31	10.625°C
14/07/11 23:41	10.75°C
14/07/11 23:51	10.75°C
15/07/11 00:01	10.75°C
15/07/11 00:11	10.75°C
15/07/11 00:21	10.75°C
15/07/11 00:31	10.75°C
15/07/11 00:41	10.75°C
15/07/11 00:51	10.75°C
15/07/11 01:01	10.75°C
15/07/11 01:11	10.75°C
15/07/11 01:21	10.75°C
15/07/11 01:31	10.875°C
15/07/11 01:41	10.875°C
15/07/11 01:51	10.875°C
15/07/11 02:01	10.875°C
15/07/11 02:11	10.875°C

Date	Temperature Reading
15/07/11 02:21	10.875°C
15/07/11 02:31	10.875°C
15/07/11 02:41	10.875°C
15/07/11 02:51	10.875°C
15/07/11 03:01	10.875°C
15/07/11 03:11	11°C
15/07/11 03:21	11°C
15/07/11 03:31	11°C
15/07/11 03:41	11°C
15/07/11 03:51	11°C
15/07/11 04:01	11°C
15/07/11 04:11	11°C
15/07/11 04:21	11°C
15/07/11 04:31	11°C
15/07/11 04:41	11°C
15/07/11 04:51	11°C
15/07/11 05:01	11°C
15/07/11 05:11	11°C
15/07/11 05:21	11°C
15/07/11 05:31	11.125°C
15/07/11 05:41	11.125°C
15/07/11 05:51	11.125°C
15/07/11 06:01	11.125°C
15/07/11 06:11	11.125°C
15/07/11 06:21	11.125°C
15/07/11 06:31	11.125°C
15/07/11 06:41	11.125°C
15/07/11 06:51	11.125°C
15/07/11 07:01	11.125°C
15/07/11 07:11	11.125°C
15/07/11 07:21	11.25°C
15/07/11 07:31	11.25°C
15/07/11 07:41	11.25°C
15/07/11 07:51	11.25°C
15/07/11 08:01	11.25°C
15/07/11 08:11	11.25°C
15/07/11 08:21	11.25°C
15/07/11 08:31	11.25°C
15/07/11 08:41	11.25°C
15/07/11 08:51	11.375°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
15/07/11 09:01	11.375°C
15/07/11 09:11	11.375°C
15/07/11 09:21	11.375°C
15/07/11 09:31	11.375°C
15/07/11 09:41	11.375°C
15/07/11 09:51	11.5°C
15/07/11 10:01	11.5°C
15/07/11 10:11	11.5°C
15/07/11 10:21	11.5°C
15/07/11 10:31	11.5°C
15/07/11 10:41	11.625°C
15/07/11 10:51	11.625°C
15/07/11 11:01	11.625°C
15/07/11 11:11	11.625°C
15/07/11 11:21	11.75°C
15/07/11 11:31	11.75°C
15/07/11 11:41	11.75°C
15/07/11 11:51	11.75°C
15/07/11 12:01	11.875°C
15/07/11 12:11	11.875°C
15/07/11 12:21	11.875°C
15/07/11 12:31	11.875°C
15/07/11 12:41	12°C
15/07/11 12:51	12°C
15/07/11 13:01	12°C
15/07/11 13:11	12°C
15/07/11 13:21	12.125°C
15/07/11 13:31	12.125°C
15/07/11 13:41	12.25°C
15/07/11 13:51	12.25°C
15/07/11 14:01	12.25°C
15/07/11 14:11	12.25°C
15/07/11 14:21	12.25°C
15/07/11 14:31	12.25°C
15/07/11 14:41	12.375°C
15/07/11 14:51	12.375°C
15/07/11 15:01	12.375°C
15/07/11 15:11	12.375°C
15/07/11 15:21	12.375°C
15/07/11 15:31	12.375°C

Date	Temperature Reading
15/07/11 15:41	12.375°C
15/07/11 15:51	12.375°C
15/07/11 16:01	12.375°C
15/07/11 16:11	12.375°C
15/07/11 16:21	12.5°C
15/07/11 16:31	12.5°C
15/07/11 16:41	12.5°C
15/07/11 16:51	12.5°C
15/07/11 17:01	12.5°C
15/07/11 17:11	12.5°C
15/07/11 17:21	12.5°C
15/07/11 17:31	12.5°C
15/07/11 17:41	12.5°C
15/07/11 17:51	12.5°C
15/07/11 18:01	12.5°C
15/07/11 18:11	12.5°C
15/07/11 18:21	12.5°C
15/07/11 18:31	12.5°C
15/07/11 18:41	12.5°C
15/07/11 18:51	12.5°C
15/07/11 19:01	12.5°C
15/07/11 19:11	12.5°C
15/07/11 19:21	12.5°C
15/07/11 19:31	12.5°C
15/07/11 19:41	12.5°C
15/07/11 19:51	12.5°C
15/07/11 20:01	12.5°C
15/07/11 20:11	12.5°C
15/07/11 20:21	12.5°C
15/07/11 20:31	12.5°C
15/07/11 20:41	12.5°C
15/07/11 20:51	12.625°C
15/07/11 21:01	12.625°C
15/07/11 21:11	12.625°C
15/07/11 21:21	12.625°C
15/07/11 21:31	12.625°C
15/07/11 21:41	12.625°C
15/07/11 21:51	12.625°C
15/07/11 22:01	12.625°C
15/07/11 22:11	12.625°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
15/07/11 22:21	12.625°C
15/07/11 22:31	12.625°C
15/07/11 22:41	12.625°C
15/07/11 22:51	12.625°C
15/07/11 23:01	12.625°C
15/07/11 23:11	12.625°C
15/07/11 23:21	12.625°C
15/07/11 23:31	12.625°C
15/07/11 23:41	12.625°C
15/07/11 23:51	12.625°C
16/07/11 00:01	12.625°C
16/07/11 00:11	12.625°C
16/07/11 00:21	12.625°C
16/07/11 00:31	12.625°C
16/07/11 00:41	12.625°C
16/07/11 00:51	12.625°C
16/07/11 01:01	12.625°C
16/07/11 01:11	12.625°C
16/07/11 01:21	12.625°C
16/07/11 01:31	12.625°C
16/07/11 01:41	12.625°C
16/07/11 01:51	12.625°C
16/07/11 02:01	12.625°C
16/07/11 02:11	12.625°C
16/07/11 02:21	12.75°C
16/07/11 02:31	12.75°C
16/07/11 02:41	12.75°C
16/07/11 02:51	12.75°C
16/07/11 03:01	12.75°C
16/07/11 03:11	12.75°C
16/07/11 03:21	12.75°C
16/07/11 03:31	12.75°C
16/07/11 03:41	12.75°C
16/07/11 03:51	12.75°C
16/07/11 04:01	12.375°C
16/07/11 04:11	12.125°C
16/07/11 04:21	12.25°C
16/07/11 04:31	12.375°C
16/07/11 04:41	12.375°C
16/07/11 04:51	12.375°C

Date	Temperature Reading
16/07/11 05:01	12.375°C
16/07/11 05:11	12.375°C
16/07/11 05:21	12.375°C
16/07/11 05:31	12.375°C
16/07/11 05:41	12.375°C
16/07/11 05:51	12.5°C
16/07/11 06:01	12.5°C
16/07/11 06:11	12.5°C
16/07/11 06:21	12.5°C
16/07/11 06:31	12.5°C
16/07/11 06:41	12.5°C
16/07/11 06:51	12.5°C
16/07/11 07:01	12.5°C
16/07/11 07:11	12.5°C
16/07/11 07:21	12.5°C
16/07/11 07:31	12.5°C
16/07/11 07:41	12.5°C
16/07/11 07:51	12.5°C
16/07/11 08:01	12.5°C
16/07/11 08:11	12.625°C
16/07/11 08:21	12.625°C
16/07/11 08:31	12.625°C
16/07/11 08:41	12.625°C
16/07/11 08:51	12.625°C
16/07/11 09:01	12.625°C
16/07/11 09:11	12.75°C
16/07/11 09:21	12.75°C
16/07/11 09:31	12.75°C
16/07/11 09:41	12.75°C
16/07/11 09:51	12.875°C
16/07/11 10:01	12.875°C
16/07/11 10:11	12.875°C
16/07/11 10:21	13°C
16/07/11 10:31	13°C
16/07/11 10:41	13°C
16/07/11 10:51	13.125°C
16/07/11 11:01	13.125°C
16/07/11 11:11	13.25°C
16/07/11 11:21	13.25°C
16/07/11 11:31	13.25°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading	Date	Temperature Reading
16/07/11 11:41	13.375°C	16/07/11 18:21	14.625°C
16/07/11 11:51	13.375°C	16/07/11 18:31	14.625°C
16/07/11 12:01	13.5°C	16/07/11 18:41	14.75°C
16/07/11 12:11	13.5°C	16/07/11 18:51	14.75°C
16/07/11 12:21	13.625°C	16/07/11 19:01	14.75°C
16/07/11 12:31	13.625°C	16/07/11 19:11	14.75°C
16/07/11 12:41	13.625°C	16/07/11 19:21	14.75°C
16/07/11 12:51	13.75°C	16/07/11 19:31	14.875°C
16/07/11 13:01	13.75°C	16/07/11 19:41	14.875°C
16/07/11 13:11	13.875°C	16/07/11 19:51	14.875°C
16/07/11 13:21	13.875°C	16/07/11 20:01	14.875°C
16/07/11 13:31	14°C	16/07/11 20:11	14.875°C
16/07/11 13:41	14°C	16/07/11 20:21	14.875°C
16/07/11 13:51	14.125°C	16/07/11 20:31	14.875°C
16/07/11 14:01	14.125°C	16/07/11 20:41	14.875°C
16/07/11 14:11	14.25°C	16/07/11 20:51	14.875°C
16/07/11 14:21	14.25°C	16/07/11 21:01	14.875°C
16/07/11 14:31	14°C	16/07/11 21:11	14.875°C
16/07/11 14:41	13.5°C	16/07/11 21:21	15°C
16/07/11 14:51	13.375°C	16/07/11 21:31	15°C
16/07/11 15:01	13.625°C	16/07/11 21:41	15°C
16/07/11 15:11	13.75°C	16/07/11 21:51	15°C
16/07/11 15:21	13.875°C	16/07/11 22:01	15°C
16/07/11 15:31	14°C	16/07/11 22:11	15°C
16/07/11 15:41	14°C	16/07/11 22:21	15°C
16/07/11 15:51	14°C	16/07/11 22:31	15°C
16/07/11 16:01	14.125°C	16/07/11 22:41	15°C
16/07/11 16:11	14.125°C	16/07/11 22:51	15°C
16/07/11 16:21	14.25°C	16/07/11 23:01	15°C
16/07/11 16:31	14.25°C	16/07/11 23:11	15°C
16/07/11 16:41	14.25°C	16/07/11 23:21	15°C
16/07/11 16:51	14.375°C	16/07/11 23:31	15°C
16/07/11 17:01	14.375°C	16/07/11 23:41	15°C
16/07/11 17:11	14.375°C	16/07/11 23:51	15°C
16/07/11 17:21	14.5°C	17/07/11 00:01	15°C
16/07/11 17:31	14.5°C	17/07/11 00:11	15°C
16/07/11 17:41	14.5°C	17/07/11 00:21	15°C
16/07/11 17:51	14.625°C	17/07/11 00:31	15°C
16/07/11 18:01	14.625°C	17/07/11 00:41	15°C
16/07/11 18:11	14.625°C	17/07/11 00:51	15°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
17/07/11 01:01	15°C
17/07/11 01:11	15°C
17/07/11 01:21	15°C
17/07/11 01:31	15°C
17/07/11 01:41	15°C
17/07/11 01:51	15°C
17/07/11 02:01	15°C
17/07/11 02:11	15°C
17/07/11 02:21	15°C
17/07/11 02:31	15°C
17/07/11 02:41	15°C
17/07/11 02:51	15°C
17/07/11 03:01	15°C
17/07/11 03:11	15°C
17/07/11 03:21	15°C
17/07/11 03:31	15°C
17/07/11 03:41	15°C
17/07/11 03:51	15°C
17/07/11 04:01	15°C
17/07/11 04:11	15°C
17/07/11 04:21	15°C
17/07/11 04:31	15°C
17/07/11 04:41	15°C
17/07/11 04:51	15°C
17/07/11 05:01	15°C
17/07/11 05:11	15°C
17/07/11 05:21	15°C
17/07/11 05:31	15°C
17/07/11 05:41	15°C
17/07/11 05:51	15°C
17/07/11 06:01	15°C
17/07/11 06:11	15°C
17/07/11 06:21	15°C
17/07/11 06:31	15°C
17/07/11 06:41	15°C
17/07/11 06:51	15°C
17/07/11 07:01	15°C
17/07/11 07:11	15°C
17/07/11 07:21	15°C
17/07/11 07:31	15°C

Date	Temperature Reading
17/07/11 07:41	15°C
17/07/11 07:51	14.75°C
17/07/11 08:01	14.125°C
17/07/11 08:11	14.375°C
17/07/11 08:21	14.5°C
17/07/11 08:31	14.5°C
17/07/11 08:41	14.5°C
17/07/11 08:51	14.5°C
17/07/11 09:01	14.5°C
17/07/11 09:11	14.5°C
17/07/11 09:21	14.5°C
17/07/11 09:31	14.5°C
17/07/11 09:41	14.625°C
17/07/11 09:51	14.625°C
17/07/11 10:01	14.625°C
17/07/11 10:11	14.625°C
17/07/11 10:21	14.625°C
17/07/11 10:31	14.625°C
17/07/11 10:41	14.625°C
17/07/11 10:51	14.75°C
17/07/11 11:01	14.75°C
17/07/11 11:11	14.75°C
17/07/11 11:21	14.75°C
17/07/11 11:31	14.875°C
17/07/11 11:41	14.875°C
17/07/11 11:51	15°C
17/07/11 12:01	15°C
17/07/11 12:11	15°C
17/07/11 12:21	15.125°C
17/07/11 12:31	15.125°C
17/07/11 12:41	15.25°C
17/07/11 12:51	15.25°C
17/07/11 13:01	15.25°C
17/07/11 13:11	15.375°C
17/07/11 13:21	15.375°C
17/07/11 13:31	15.375°C
17/07/11 13:41	15.375°C
17/07/11 13:51	15.375°C
17/07/11 14:01	15.5°C
17/07/11 14:11	15.5°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
17/07/11 14:21	15.5°C
17/07/11 14:31	15.5°C
17/07/11 14:41	15.5°C
17/07/11 14:51	15.625°C
17/07/11 15:01	15.625°C
17/07/11 15:11	15.625°C
17/07/11 15:21	15.625°C
17/07/11 15:31	15.75°C
17/07/11 15:41	15.75°C
17/07/11 15:51	15.75°C
17/07/11 16:01	15.75°C
17/07/11 16:11	15.75°C
17/07/11 16:21	15.875°C
17/07/11 16:31	15.875°C
17/07/11 16:41	15.875°C
17/07/11 16:51	15.875°C
17/07/11 17:01	16°C
17/07/11 17:11	16°C
17/07/11 17:21	16°C
17/07/11 17:31	16°C
17/07/11 17:41	16.125°C
17/07/11 17:51	16.125°C
17/07/11 18:01	16.125°C
17/07/11 18:11	16.125°C
17/07/11 18:21	16.125°C
17/07/11 18:31	16.125°C
17/07/11 18:41	16.25°C
17/07/11 18:51	16.25°C
17/07/11 19:01	16.25°C
17/07/11 19:11	16.25°C
17/07/11 19:21	16.25°C
17/07/11 19:31	16.25°C
17/07/11 19:41	16.25°C
17/07/11 19:51	16.375°C
17/07/11 20:01	16.375°C
17/07/11 20:11	16.375°C
17/07/11 20:21	16.375°C
17/07/11 20:31	16°C
17/07/11 20:41	15.5°C
17/07/11 20:51	15.25°C

Date	Temperature Reading
17/07/11 21:01	15.5°C
17/07/11 21:11	15.625°C
17/07/11 21:21	15.625°C
17/07/11 21:31	15.625°C
17/07/11 21:41	15.625°C
17/07/11 21:51	15.625°C
17/07/11 22:01	15.625°C
17/07/11 22:11	15.75°C
17/07/11 22:21	15.75°C
17/07/11 22:31	15.75°C
17/07/11 22:41	15.75°C
17/07/11 22:51	15.75°C
17/07/11 23:01	15.75°C
17/07/11 23:11	15.75°C
17/07/11 23:21	15.75°C
17/07/11 23:31	15.75°C
17/07/11 23:41	15.75°C
17/07/11 23:51	15.75°C
18/07/11 00:01	15.75°C
18/07/11 00:11	15.75°C
18/07/11 00:21	15.75°C
18/07/11 00:31	15.75°C
18/07/11 00:41	15.75°C
18/07/11 00:51	15.75°C
18/07/11 01:01	15.75°C
18/07/11 01:11	15.75°C
18/07/11 01:21	15.75°C
18/07/11 01:31	15.75°C
18/07/11 01:41	15.75°C
18/07/11 01:51	15.75°C
18/07/11 02:01	15.75°C
18/07/11 02:11	15.75°C
18/07/11 02:21	15.75°C
18/07/11 02:31	15.75°C
18/07/11 02:41	15.75°C
18/07/11 02:51	15.75°C
18/07/11 03:01	15.75°C
18/07/11 03:11	15.875°C
18/07/11 03:21	15.875°C
18/07/11 03:31	15.875°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading	Date	Temperature Reading
18/07/11 03:41	15.875°C	18/07/11 10:21	19.625°C
18/07/11 03:51	15.875°C	18/07/11 10:31	19.75°C
18/07/11 04:01	15.875°C	18/07/11 10:41	20°C
18/07/11 04:11	15.875°C	18/07/11 10:51	20.125°C
18/07/11 04:21	15.875°C	18/07/11 11:01	20°C
18/07/11 04:31	15.875°C	18/07/11 11:11	19.75°C
18/07/11 04:41	15.875°C	18/07/11 11:21	19.625°C
18/07/11 04:51	15.875°C	18/07/11 11:31	19.5°C
18/07/11 05:01	15.875°C	18/07/11 11:41	19.375°C
18/07/11 05:11	15.875°C	18/07/11 11:51	19.375°C
18/07/11 05:21	15.875°C	18/07/11 12:01	19.25°C
18/07/11 05:31	15.875°C	18/07/11 12:11	19.25°C
18/07/11 05:41	15.875°C	18/07/11 12:21	19.125°C
18/07/11 05:51	15.875°C	18/07/11 12:31	19.125°C
18/07/11 06:01	15.875°C	18/07/11 12:41	19.125°C
18/07/11 06:11	15.875°C	18/07/11 12:51	19°C
18/07/11 06:21	15.875°C	18/07/11 13:01	19°C
18/07/11 06:31	15.875°C	18/07/11 13:11	19°C
18/07/11 06:41	16°C	18/07/11 13:21	19°C
18/07/11 06:51	16°C	18/07/11 13:31	19.125°C
18/07/11 07:01	16°C	18/07/11 13:41	19.25°C
18/07/11 07:11	16.5°C	18/07/11 13:51	19.5°C
18/07/11 07:21	16.75°C	18/07/11 14:01	19.625°C
18/07/11 07:31	17.125°C	18/07/11 14:11	19.75°C
18/07/11 07:41	17.375°C	18/07/11 14:21	19.875°C
18/07/11 07:51	17.5°C	18/07/11 14:31	20°C
18/07/11 08:01	17.625°C	18/07/11 14:41	20.25°C
18/07/11 08:11	18°C	18/07/11 14:51	20.375°C
18/07/11 08:21	18.125°C	18/07/11 15:01	20.625°C
18/07/11 08:31	18.25°C	18/07/11 15:11	20.875°C
18/07/11 08:41	18.375°C	18/07/11 15:21	20.5°C
18/07/11 08:51	18.5°C	18/07/11 15:31	20.375°C
18/07/11 09:01	18.375°C	18/07/11 15:41	20.375°C
18/07/11 09:11	18.5°C	18/07/11 15:51	20.375°C
18/07/11 09:21	18.5°C	18/07/11 16:01	20.375°C
18/07/11 09:31	18.75°C	18/07/11 16:11	20.375°C
18/07/11 09:41	18.875°C	18/07/11 16:21	20.5°C
18/07/11 09:51	19.125°C	18/07/11 16:31	20.5°C
18/07/11 10:01	19.25°C	18/07/11 16:41	20.5°C
18/07/11 10:11	19.5°C	18/07/11 16:51	20.5°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
18/07/11 17:01	20.5°C
18/07/11 17:11	20.5°C
18/07/11 17:21	20.625°C
18/07/11 17:31	20.625°C
18/07/11 17:41	20.625°C
18/07/11 17:51	20.625°C
18/07/11 18:01	20.625°C
18/07/11 18:11	20.625°C
18/07/11 18:21	20.875°C
18/07/11 18:31	21°C
18/07/11 18:41	20.875°C
18/07/11 18:51	20.875°C
18/07/11 19:01	20.875°C
18/07/11 19:11	20.875°C
18/07/11 19:21	20.875°C
18/07/11 19:31	20.75°C
18/07/11 19:41	21°C
18/07/11 19:51	21°C
18/07/11 20:01	21°C
18/07/11 20:11	21.125°C
18/07/11 20:21	21.125°C
18/07/11 20:31	21.125°C
18/07/11 20:41	21.125°C
18/07/11 20:51	21.125°C
18/07/11 21:01	21°C
18/07/11 21:11	21°C
18/07/11 21:21	21°C
18/07/11 21:31	21°C
18/07/11 21:41	21°C
18/07/11 21:51	21°C
18/07/11 22:01	20.875°C
18/07/11 22:11	20.875°C
18/07/11 22:21	20.75°C
18/07/11 22:31	20.75°C
18/07/11 22:41	20.75°C
18/07/11 22:51	20.75°C
18/07/11 23:01	20.75°C
18/07/11 23:11	20.625°C
18/07/11 23:21	20.625°C
18/07/11 23:31	20.625°C

Date	Temperature Reading
18/07/11 23:41	20.5°C
18/07/11 23:51	20.5°C
19/07/11 00:01	20.375°C
19/07/11 00:11	20.375°C
19/07/11 00:21	20.375°C
19/07/11 00:31	20.25°C
19/07/11 00:41	20.25°C
19/07/11 00:51	20.25°C
19/07/11 01:01	20.125°C
19/07/11 01:11	20.125°C
19/07/11 01:21	20°C
19/07/11 01:31	20°C
19/07/11 01:41	19.875°C
19/07/11 01:51	19.875°C
19/07/11 02:01	19.75°C
19/07/11 02:11	19.75°C
19/07/11 02:21	19.625°C
19/07/11 02:31	19.625°C
19/07/11 02:41	19.5°C
19/07/11 02:51	19.5°C
19/07/11 03:01	19.375°C
19/07/11 03:11	19.375°C
19/07/11 03:21	19.25°C
19/07/11 03:31	19.25°C
19/07/11 03:41	19.125°C
19/07/11 03:51	19.125°C
19/07/11 04:01	19°C
19/07/11 04:11	18.875°C
19/07/11 04:21	18.875°C
19/07/11 04:31	18.75°C
19/07/11 04:41	18.75°C
19/07/11 04:51	18.625°C
19/07/11 05:01	18.625°C
19/07/11 05:11	18.5°C
19/07/11 05:21	18.375°C
19/07/11 05:31	18.375°C
19/07/11 05:41	18.25°C
19/07/11 05:51	18.25°C
19/07/11 06:01	18.125°C
19/07/11 06:11	18°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
19/07/11 06:21	18°C
19/07/11 06:31	17.875°C
19/07/11 06:41	17.875°C
19/07/11 06:51	17.75°C
19/07/11 07:01	17.75°C
19/07/11 07:11	17.625°C
19/07/11 07:21	17.5°C
19/07/11 07:31	17.5°C
19/07/11 07:41	17.375°C
19/07/11 07:51	17.25°C
19/07/11 08:01	17.25°C
19/07/11 08:11	17.125°C
19/07/11 08:21	17.125°C
19/07/11 08:31	17°C
19/07/11 08:41	16.875°C
19/07/11 08:51	16.875°C
19/07/11 09:01	16.75°C
19/07/11 09:11	16.75°C
19/07/11 09:21	16.625°C
19/07/11 09:31	16.5°C
19/07/11 09:41	16.5°C
19/07/11 09:51	16.375°C
19/07/11 10:01	16.375°C
19/07/11 10:11	16.25°C
19/07/11 10:21	16.25°C
19/07/11 10:31	16.125°C
19/07/11 10:41	16.125°C
19/07/11 10:51	16°C
19/07/11 11:01	15.875°C
19/07/11 11:11	15.875°C
19/07/11 11:21	15.75°C
19/07/11 11:31	15.75°C
19/07/11 11:41	15.625°C
19/07/11 11:51	15.625°C
19/07/11 12:01	15.5°C
19/07/11 12:11	15.5°C
19/07/11 12:21	15.375°C
19/07/11 12:31	15.25°C
19/07/11 12:41	15.25°C
19/07/11 12:51	15.125°C

Date	Temperature Reading
19/07/11 13:01	15.125°C
19/07/11 13:11	15°C
19/07/11 13:21	15°C
19/07/11 13:31	14.875°C
19/07/11 13:41	14.875°C
19/07/11 13:51	14.75°C
19/07/11 14:01	14.75°C
19/07/11 14:11	14.625°C
19/07/11 14:21	14.625°C
19/07/11 14:31	14.5°C
19/07/11 14:41	14.5°C
19/07/11 14:51	14.375°C
19/07/11 15:01	14.375°C
19/07/11 15:11	14.25°C
19/07/11 15:21	14.25°C
19/07/11 15:31	14.125°C
19/07/11 15:41	14.125°C
19/07/11 15:51	14°C
19/07/11 16:01	14°C
19/07/11 16:11	13.875°C
19/07/11 16:21	13.875°C
19/07/11 16:31	13.75°C
19/07/11 16:41	13.75°C
19/07/11 16:51	13.75°C
19/07/11 17:01	13.625°C
19/07/11 17:11	13.5°C
19/07/11 17:21	13.5°C
19/07/11 17:31	13.375°C
19/07/11 17:41	13.25°C
19/07/11 17:51	13.25°C
19/07/11 18:01	13.25°C
19/07/11 18:11	13.125°C
19/07/11 18:21	13.125°C
19/07/11 18:31	13°C
19/07/11 18:41	13°C
19/07/11 18:51	12.875°C
19/07/11 19:01	12.875°C
19/07/11 19:11	12.875°C
19/07/11 19:21	12.75°C
19/07/11 19:31	12.625°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
19/07/11 19:41	12.625°C
19/07/11 19:51	12.5°C
19/07/11 20:01	12.375°C
19/07/11 20:11	12.375°C
19/07/11 20:21	12.25°C
19/07/11 20:31	12.25°C
19/07/11 20:41	12.125°C
19/07/11 20:51	12.125°C
19/07/11 21:01	12°C
19/07/11 21:11	11.875°C
19/07/11 21:21	11.875°C
19/07/11 21:31	11.75°C
19/07/11 21:41	11.625°C
19/07/11 21:51	11.625°C
19/07/11 22:01	11.5°C
19/07/11 22:11	11.5°C
19/07/11 22:21	11.375°C
19/07/11 22:31	11.25°C
19/07/11 22:41	11.25°C
19/07/11 22:51	11.125°C
19/07/11 23:01	11.125°C
19/07/11 23:11	11°C
19/07/11 23:21	10.875°C
19/07/11 23:31	10.875°C
19/07/11 23:41	10.75°C
19/07/11 23:51	10.625°C
20/07/11 00:01	10.625°C
20/07/11 00:11	10.5°C
20/07/11 00:21	10.5°C
20/07/11 00:31	10.375°C
20/07/11 00:41	10.25°C
20/07/11 00:51	10.25°C
20/07/11 01:01	10.125°C
20/07/11 01:11	10.125°C
20/07/11 01:21	10°C
20/07/11 01:31	10°C
20/07/11 01:41	9.875°C
20/07/11 01:51	9.75°C
20/07/11 02:01	9.75°C
20/07/11 02:11	9.625°C

Date	Temperature Reading
20/07/11 02:21	9.625°C
20/07/11 02:31	9.5°C
20/07/11 02:41	9.5°C
20/07/11 02:51	9.375°C
20/07/11 03:01	9.375°C
20/07/11 03:11	9.25°C
20/07/11 03:21	9.25°C
20/07/11 03:31	9.125°C
20/07/11 03:41	9.125°C
20/07/11 03:51	9°C
20/07/11 04:01	8.875°C
20/07/11 04:11	8.875°C
20/07/11 04:21	8.75°C
20/07/11 04:31	8.75°C
20/07/11 04:41	8.75°C
20/07/11 04:51	8.625°C
20/07/11 05:01	8.625°C
20/07/11 05:11	8.5°C
20/07/11 05:21	8.5°C
20/07/11 05:31	8.375°C
20/07/11 05:41	8.375°C
20/07/11 05:51	8.25°C
20/07/11 06:01	8.25°C
20/07/11 06:11	8.125°C
20/07/11 06:21	8.125°C
20/07/11 06:31	8.125°C
20/07/11 06:41	8°C
20/07/11 06:51	8°C
20/07/11 07:01	7.875°C
20/07/11 07:11	7.875°C
20/07/11 07:21	7.75°C
20/07/11 07:31	7.75°C
20/07/11 07:41	7.75°C
20/07/11 07:51	7.75°C
20/07/11 08:01	7.75°C
20/07/11 08:11	7.625°C
20/07/11 08:21	7.625°C
20/07/11 08:31	7.625°C
20/07/11 08:41	7.625°C
20/07/11 08:51	7.625°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
20/07/11 09:01	7.75°C
20/07/11 09:11	7.75°C
20/07/11 09:21	7.75°C
20/07/11 09:31	7.75°C
20/07/11 09:41	7.875°C
20/07/11 09:51	7.875°C
20/07/11 10:01	7.875°C
20/07/11 10:11	8°C
20/07/11 10:21	8.125°C
20/07/11 10:31	8.125°C
20/07/11 10:41	8.25°C
20/07/11 10:51	8.25°C
20/07/11 11:01	8.375°C
20/07/11 11:11	8.375°C
20/07/11 11:21	8.5°C
20/07/11 11:31	8.625°C
20/07/11 11:41	8.625°C
20/07/11 11:51	8.75°C
20/07/11 12:01	8.875°C
20/07/11 12:11	8.875°C
20/07/11 12:21	9°C
20/07/11 12:31	9.125°C
20/07/11 12:41	9.25°C
20/07/11 12:51	9.25°C
20/07/11 13:01	9.375°C
20/07/11 13:11	9.5°C
20/07/11 13:21	9.5°C
20/07/11 13:31	9.625°C
20/07/11 13:41	9.75°C
20/07/11 13:51	9.75°C
20/07/11 14:01	9.875°C
20/07/11 14:11	10°C
20/07/11 14:21	10.125°C
20/07/11 14:31	10.125°C
20/07/11 14:41	10.25°C
20/07/11 14:51	10.375°C
20/07/11 15:01	10.5°C
20/07/11 15:11	10.5°C
20/07/11 15:21	10.625°C
20/07/11 15:31	10.75°C

Date	Temperature Reading
20/07/11 15:41	10.875°C
20/07/11 15:51	10.875°C
20/07/11 16:01	11°C
20/07/11 16:11	11.125°C
20/07/11 16:21	11.25°C
20/07/11 16:31	11.25°C
20/07/11 16:41	11.375°C
20/07/11 16:51	11.5°C
20/07/11 17:01	11.625°C
20/07/11 17:11	11.75°C
20/07/11 17:21	11.75°C
20/07/11 17:31	11.875°C
20/07/11 17:41	12°C
20/07/11 17:51	12.125°C
20/07/11 18:01	12.125°C
20/07/11 18:11	12.25°C
20/07/11 18:21	12.375°C
20/07/11 18:31	12.375°C
20/07/11 18:41	12.5°C
20/07/11 18:51	12.5°C
20/07/11 19:01	12.625°C
20/07/11 19:11	12.75°C
20/07/11 19:21	12.75°C
20/07/11 19:31	12.875°C
20/07/11 19:41	13°C
20/07/11 19:51	13°C
20/07/11 20:01	13.125°C
20/07/11 20:11	13.125°C
20/07/11 20:21	13.25°C
20/07/11 20:31	13.25°C
20/07/11 20:41	13.375°C
20/07/11 20:51	13.375°C
20/07/11 21:01	13.5°C
20/07/11 21:11	13.625°C
20/07/11 21:21	13.625°C
20/07/11 21:31	13.75°C
20/07/11 21:41	13.75°C
20/07/11 21:51	13.875°C
20/07/11 22:01	13.875°C
20/07/11 22:11	14°C

Table B1$_{contd}$: Environmental temperature recording along Supply Chain 1

Date	Temperature Reading
20/07/11 22:21	14.125°C
20/07/11 22:31	14.125°C
20/07/11 22:41	14.25°C
20/07/11 22:51	14.25°C
20/07/11 23:01	14.375°C
20/07/11 23:11	14.5°C
20/07/11 23:21	14.5°C
20/07/11 23:31	14.625°C
20/07/11 23:41	14.625°C
20/07/11 23:51	14.75°C
21/07/11 00:01	14.875°C
21/07/11 00:11	14.875°C
21/07/11 00:21	15°C
21/07/11 00:31	15°C
21/07/11 00:41	15.125°C
21/07/11 00:51	15.25°C
21/07/11 01:01	15.25°C
21/07/11 01:11	15.375°C
21/07/11 01:21	15.5°C
21/07/11 01:31	15.5°C
21/07/11 01:41	15.625°C
21/07/11 01:51	15.625°C
21/07/11 02:01	15.75°C
21/07/11 02:11	15.875°C
21/07/11 02:21	15.875°C
21/07/11 02:31	16°C
21/07/11 02:41	16°C
21/07/11 02:51	16.125°C
21/07/11 03:01	16.25°C
21/07/11 03:11	16.25°C
21/07/11 03:21	16.375°C
21/07/11 03:31	16.375°C
21/07/11 03:41	16.5°C
21/07/11 03:51	16.625°C
21/07/11 04:01	16.625°C
21/07/11 04:11	16.75°C
21/07/11 04:21	16.875°C
21/07/11 04:31	16.875°C

Date	Temperature Reading
21/07/11 04:41	17°C
21/07/11 04:51	17°C
21/07/11 05:01	17.125°C
21/07/11 05:11	17.125°C
21/07/11 05:21	17.25°C
21/07/11 05:31	17.375°C
21/07/11 05:41	17.375°C
21/07/11 05:51	17.5°C
21/07/11 06:01	17.5°C
21/07/11 06:11	17.625°C
21/07/11 06:21	17.625°C
21/07/11 06:31	17.75°C
21/07/11 06:41	17.75°C
21/07/11 06:51	17.875°C
21/07/11 07:01	18°C
21/07/11 07:11	18°C
21/07/11 07:21	18.125°C
21/07/11 07:31	18.125°C
21/07/11 07:41	18.125°C
21/07/11 07:51	18.25°C
21/07/11 08:01	18.25°C
21/07/11 08:11	18.375°C
21/07/11 08:21	18.375°C
21/07/11 08:31	18.5°C
21/07/11 08:41	18.5°C
21/07/11 08:51	18.625°C
21/07/11 09:01	18.625°C
21/07/11 09:11	18.625°C
21/07/11 09:21	18.75°C
21/07/11 09:31	18.75°C
21/07/11 09:41	18.875°C
21/07/11 09:51	18.875°C
21/07/11 10:01	18.875°C
21/07/11 10:11	19°C
21/07/11 10:21	19°C

B2: Temperature recordings along Supply Chain 2

Table B2: Environmental temperature recording along Supply Chain 2

Date	Temperature Reading
27/07/11 10:57	26.375°C
27/07/11 11:07	26.375°C
27/07/11 11:17	25.75°C
27/07/11 11:27	25.75°C
27/07/11 11:37	25.5°C
27/07/11 11:47	26°C
27/07/11 11:57	26.375°C
27/07/11 12:07	26.375°C
27/07/11 12:17	24.125°C
27/07/11 12:27	6.25°C
27/07/11 12:37	3.125°C
27/07/11 12:47	2.875°C
27/07/11 12:57	3°C
27/07/11 13:07	3°C
27/07/11 13:17	3°C
27/07/11 13:27	2.875°C
27/07/11 13:37	2.75°C
27/07/11 13:47	2.5°C
27/07/11 13:57	2.375°C
27/07/11 14:07	2.5°C
27/07/11 14:17	2.5°C
27/07/11 14:27	2.625°C
27/07/11 14:37	2.75°C
27/07/11 14:47	2.875°C
27/07/11 14:57	2.875°C
27/07/11 15:07	3°C
27/07/11 15:17	3.125°C
27/07/11 15:27	3.125°C
27/07/11 15:37	3.25°C
27/07/11 15:47	3.375°C
27/07/11 15:57	3.375°C
27/07/11 16:07	3.5°C
27/07/11 16:17	3.5°C
27/07/11 16:27	3.625°C
27/07/11 16:37	3.5°C
27/07/11 16:47	3°C
27/07/11 16:57	2.75°C
27/07/11 17:07	2.75°C
27/07/11 17:17	2.625°C
27/07/11 17:27	2.625°C
27/07/11 17:37	2.75°C
27/07/11 17:47	2.875°C
27/07/11 17:57	2.875°C
27/07/11 18:07	3°C
27/07/11 18:17	3.125°C
27/07/11 18:27	3.25°C
27/07/11 18:37	3.25°C
27/07/11 18:47	3.25°C
27/07/11 18:57	3.375°C
27/07/11 19:07	3.5°C
27/07/11 19:17	3.5°C
27/07/11 19:27	3.625°C
27/07/11 19:37	3.625°C

Date	Temperature Reading
27/07/11 19:47	3.75°C
27/07/11 19:57	3.75°C
27/07/11 20:07	3.875°C
27/07/11 20:17	3.875°C
27/07/11 20:27	4°C
27/07/11 20:37	4°C
27/07/11 20:47	4°C
27/07/11 20:57	4.125°C
27/07/11 21:07	4.125°C
27/07/11 21:17	4.25°C
27/07/11 21:27	4°C
27/07/11 21:37	3.75°C
27/07/11 21:47	3.625°C
27/07/11 21:57	3.625°C
27/07/11 22:07	3.625°C
27/07/11 22:17	3.5°C
27/07/11 22:27	3.5°C
27/07/11 22:37	3.5°C
27/07/11 22:47	3.5°C
27/07/11 22:57	3.5°C
27/07/11 23:07	3.375°C
27/07/11 23:17	3.375°C
27/07/11 23:27	3.375°C
27/07/11 23:37	3.5°C
27/07/11 23:47	3.5°C
27/07/11 23:57	3.625°C
28/07/11 00:07	3.75°C
28/07/11 00:17	3.75°C
28/07/11 00:27	3.875°C
28/07/11 00:37	3.875°C
28/07/11 00:47	3.875°C
28/07/11 00:57	4°C
28/07/11 01:07	4°C
28/07/11 01:17	4.125°C
28/07/11 01:27	4.125°C
28/07/11 01:37	4.25°C
28/07/11 01:47	4.25°C
28/07/11 01:57	4.25°C
28/07/11 02:07	4.375°C
28/07/11 02:17	4.375°C
28/07/11 02:27	4.375°C
28/07/11 02:37	4.375°C
28/07/11 02:47	4.125°C
28/07/11 02:57	3.875°C
28/07/11 03:07	3.625°C
28/07/11 03:17	3.5°C
28/07/11 03:27	3.5°C
28/07/11 03:37	3.5°C
28/07/11 03:47	3.625°C
28/07/11 03:57	3.75°C
28/07/11 04:07	3.75°C
28/07/11 04:17	3.625°C
28/07/11 04:27	3.5°C
28/07/11 04:37	3.5°C
28/07/11 04:47	3.5°C

Table B2$_{contd}$: Environmental temperature recording along Supply Chain 2

Date	Temperature Reading
28/07/11 04:57	3.5°C
28/07/11 05:07	3.625°C
28/07/11 05:17	3.625°C
28/07/11 05:27	3.625°C
28/07/11 05:37	3.75°C
28/07/11 05:47	3.625°C
28/07/11 05:57	3.375°C
28/07/11 06:07	3.5°C
28/07/11 06:17	3.5°C
28/07/11 06:27	3.625°C
28/07/11 06:37	3.75°C
28/07/11 06:47	3.75°C
28/07/11 06:57	3.875°C
28/07/11 07:07	3.875°C
28/07/11 07:17	3.875°C
28/07/11 07:27	4°C
28/07/11 07:37	4°C
28/07/11 07:47	4.125°C
28/07/11 07:57	4.125°C
28/07/11 08:07	4.25°C
28/07/11 08:17	4.25°C
28/07/11 08:27	4.375°C
28/07/11 08:37	4.375°C
28/07/11 08:47	4.375°C
28/07/11 08:57	4°C
28/07/11 09:07	3.625°C
28/07/11 09:17	3.375°C
28/07/11 09:27	3.25°C
28/07/11 09:37	3°C
28/07/11 09:47	2.875°C
28/07/11 09:57	3°C
28/07/11 10:07	3.125°C
28/07/11 10:17	3.25°C
28/07/11 10:27	3.375°C
28/07/11 10:37	3.375°C
28/07/11 10:47	3.5°C
28/07/11 10:57	3.625°C
28/07/11 11:07	3.5°C
28/07/11 11:17	3.5°C
28/07/11 11:27	3.5°C
28/07/11 11:37	3.375°C
28/07/11 11:47	3.375°C
28/07/11 11:57	3.375°C
28/07/11 12:07	3.375°C
28/07/11 12:17	3.5°C
28/07/11 12:27	3.625°C
28/07/11 12:37	3.625°C
28/07/11 12:47	3.5°C
28/07/11 12:57	3.5°C
28/07/11 13:07	3.75°C
28/07/11 13:17	3.75°C
28/07/11 13:27	3.75°C
28/07/11 13:37	3.625°C
28/07/11 13:47	3.5°C
28/07/11 13:57	3.375°C
28/07/11 14:07	3.125°C
28/07/11 14:17	3°C
28/07/11 14:27	3°C

Date	Temperature Reading
28/07/11 14:37	3°C
28/07/11 14:47	3.25°C
28/07/11 14:57	3.125°C
28/07/11 15:07	2.75°C
28/07/11 15:17	2.5°C
28/07/11 15:27	2.75°C
28/07/11 15:37	2.875°C
28/07/11 15:47	3°C
28/07/11 15:57	3.25°C
28/07/11 16:07	3.375°C
28/07/11 16:17	3.25°C
28/07/11 16:27	3°C
28/07/11 16:37	2.5°C
28/07/11 16:47	2.125°C
28/07/11 16:57	2.125°C
28/07/11 17:07	2.125°C
28/07/11 17:17	2.25°C
28/07/11 17:27	2.375°C
28/07/11 17:37	2.5°C
28/07/11 17:47	2.625°C
28/07/11 17:57	2.75°C
28/07/11 18:07	2.875°C
28/07/11 18:17	3.125°C
28/07/11 18:27	3.125°C
28/07/11 18:37	3.25°C
28/07/11 18:47	3.25°C
28/07/11 18:57	3.375°C
28/07/11 19:07	3.375°C
28/07/11 19:17	3.75°C
28/07/11 19:27	3.75°C
28/07/11 19:37	3.75°C
28/07/11 19:47	3.875°C
28/07/11 19:57	3.875°C
28/07/11 20:07	4°C
28/07/11 20:17	4°C
28/07/11 20:27	4°C
28/07/11 20:37	4.125°C
28/07/11 20:47	4.125°C
28/07/11 20:57	4.125°C
28/07/11 21:07	4.25°C
28/07/11 21:17	4.25°C
28/07/11 21:27	4.375°C
28/07/11 21:37	4.375°C
28/07/11 21:47	4.375°C
28/07/11 21:57	4.5°C
28/07/11 22:07	4.5°C
28/07/11 22:17	4.5°C
28/07/11 22:27	4.25°C
28/07/11 22:37	3.75°C
28/07/11 22:47	3.5°C
28/07/11 22:57	3.375°C
28/07/11 23:07	3.375°C
28/07/11 23:17	3.5°C
28/07/11 23:27	3.625°C
28/07/11 23:37	3.75°C
28/07/11 23:47	3.875°C
28/07/11 23:57	4°C
29/07/11 00:07	4°C

Table B2$_{contd}$: Environmental temperature recording along Supply Chain 2

Date	Temperature Reading
29/07/11 00:17	4.125°C
29/07/11 00:27	4.125°C
29/07/11 00:37	4.125°C
29/07/11 00:47	3.625°C
29/07/11 00:57	3°C
29/07/11 01:07	2.75°C
29/07/11 01:17	2.625°C
29/07/11 01:27	2.625°C
29/07/11 01:37	2.75°C
29/07/11 01:47	2.875°C
29/07/11 01:57	3.125°C
29/07/11 02:07	3.25°C
29/07/11 02:17	3.375°C
29/07/11 02:27	3.25°C
29/07/11 02:37	3°C
29/07/11 02:47	2.875°C
29/07/11 02:57	2.875°C
29/07/11 03:07	2.875°C
29/07/11 03:17	3°C
29/07/11 03:27	2.75°C
29/07/11 03:37	2.5°C
29/07/11 03:47	2.25°C
29/07/11 03:57	2.25°C
29/07/11 04:07	2.25°C
29/07/11 04:17	2.375°C
29/07/11 04:27	2.5°C
29/07/11 04:37	2.625°C
29/07/11 04:47	2.75°C
29/07/11 04:57	2.875°C
29/07/11 05:07	3.125°C
29/07/11 05:17	3.25°C
29/07/11 05:27	3.25°C
29/07/11 05:37	3.375°C
29/07/11 05:47	3.375°C
29/07/11 05:57	3.5°C
29/07/11 06:07	3.625°C
29/07/11 06:17	3.625°C
29/07/11 06:27	3.75°C
29/07/11 06:37	3.75°C
29/07/11 06:47	3.875°C
29/07/11 06:57	3.875°C
29/07/11 07:07	3.875°C
29/07/11 07:17	3.75°C
29/07/11 07:27	3.25°C
29/07/11 07:37	2.625°C
29/07/11 07:47	2.375°C
29/07/11 07:57	2.125°C
29/07/11 08:07	2°C
29/07/11 08:17	1.75°C
29/07/11 08:27	1.5°C
29/07/11 08:37	1.25°C
29/07/11 08:47	1.375°C
29/07/11 08:57	1.5°C
29/07/11 09:07	1.625°C
29/07/11 09:17	1.75°C
29/07/11 09:27	1.875°C
29/07/11 09:37	1.875°C
29/07/11 09:47	2°C

Date	Temperature Reading
29/07/11 09:57	2.125°C
29/07/11 10:07	2.125°C
29/07/11 10:17	2.25°C
29/07/11 10:27	2.25°C
29/07/11 10:37	2.375°C
29/07/11 10:47	2.375°C
29/07/11 10:57	2.375°C
29/07/11 11:07	2.5°C
29/07/11 11:17	2.5°C
29/07/11 11:27	2.375°C
29/07/11 11:37	2°C
29/07/11 11:47	1.875°C
29/07/11 11:57	1.875°C
29/07/11 12:07	1.875°C
29/07/11 12:17	1.875°C
29/07/11 12:27	1.875°C
29/07/11 12:37	2°C
29/07/11 12:47	2.125°C
29/07/11 12:57	2.25°C
29/07/11 13:07	2.375°C
29/07/11 13:17	1.75°C
29/07/11 13:27	1.125°C
29/07/11 13:37	1.375°C
29/07/11 13:47	0.875°C
29/07/11 13:57	0.75°C
29/07/11 14:07	0.75°C
29/07/11 14:17	0.875°C
29/07/11 14:27	1°C
29/07/11 14:37	1.125°C
29/07/11 14:47	1.25°C
29/07/11 14:57	1.375°C
29/07/11 15:07	1.5°C
29/07/11 15:17	1.625°C
29/07/11 15:27	1.75°C
29/07/11 15:37	1.875°C
29/07/11 15:47	2°C
29/07/11 15:57	2°C
29/07/11 16:07	1.75°C
29/07/11 16:17	1.625°C
29/07/11 16:27	1.5°C
29/07/11 16:37	1.25°C
29/07/11 16:47	1.375°C
29/07/11 16:57	1.5°C
29/07/11 17:07	1.625°C
29/07/11 17:17	1.75°C
29/07/11 17:27	1.875°C
29/07/11 17:37	1.75°C
29/07/11 17:47	1.375°C
29/07/11 17:57	1°C
29/07/11 18:07	0.75°C
29/07/11 18:17	0.75°C
29/07/11 18:27	0.875°C
29/07/11 18:37	1.125°C
29/07/11 18:47	1.25°C
29/07/11 18:57	1.375°C
29/07/11 19:07	1.5°C
29/07/11 19:17	1.625°C
29/07/11 19:27	1.75°C

Table B2$_{contd}$: Environmental temperature recording along Supply Chain 2

Date	Temperature Reading
29/07/11 19:37	1.625°C
29/07/11 19:47	1.375°C
29/07/11 19:57	1°C
29/07/11 20:07	0.75°C
29/07/11 20:17	0.5°C
29/07/11 20:27	0.625°C
29/07/11 20:37	0.75°C
29/07/11 20:47	0.875°C
29/07/11 20:57	1°C
29/07/11 21:07	1°C
29/07/11 21:17	1.125°C
29/07/11 21:27	1.25°C
29/07/11 21:37	1.5°C
29/07/11 21:47	1.625°C
29/07/11 21:57	1.625°C
29/07/11 22:07	1.75°C
29/07/11 22:17	1.875°C
29/07/11 22:27	2°C
29/07/11 22:37	2°C
29/07/11 22:47	2.125°C
29/07/11 22:57	2.25°C
29/07/11 23:07	2.375°C
29/07/11 23:17	2.5°C
29/07/11 23:27	2.5°C
29/07/11 23:37	2.625°C
29/07/11 23:47	2.75°C
29/07/11 23:57	2.875°C
30/07/11 00:07	2.875°C
30/07/11 00:17	2.75°C
30/07/11 00:27	1.875°C
30/07/11 00:37	1.375°C
30/07/11 00:47	1°C
30/07/11 00:57	0.625°C
30/07/11 01:07	0.375°C
30/07/11 01:17	0.5°C
30/07/11 01:27	0.875°C
30/07/11 01:37	1.25°C
30/07/11 01:47	1.125°C
30/07/11 01:57	1.25°C
30/07/11 02:07	1.375°C
30/07/11 02:17	1.5°C
30/07/11 02:27	1.5°C
30/07/11 02:37	1.625°C
30/07/11 02:47	1.75°C
30/07/11 02:57	2.125°C
30/07/11 03:07	2.5°C
30/07/11 03:17	2.875°C
30/07/11 03:27	3.125°C
30/07/11 03:37	3.375°C
30/07/11 03:47	3.625°C
30/07/11 03:57	3.875°C
30/07/11 04:07	3.25°C
30/07/11 04:17	2.25°C
30/07/11 04:27	2°C
30/07/11 04:37	2°C
30/07/11 04:47	2.125°C
30/07/11 04:57	2.125°C
30/07/11 05:07	1.875°C

Date	Temperature Reading
30/07/11 05:17	1.5°C
30/07/11 05:27	1.375°C
30/07/11 05:37	1.25°C
30/07/11 05:47	1.125°C
30/07/11 05:57	1.125°C
30/07/11 06:07	1.125°C
30/07/11 06:17	1.25°C
30/07/11 06:27	1.375°C
30/07/11 06:37	1.375°C
30/07/11 06:47	1.5°C
30/07/11 06:57	1.625°C
30/07/11 07:07	1.75°C
30/07/11 07:17	1.75°C
30/07/11 07:27	2°C
30/07/11 07:37	2.125°C
30/07/11 07:47	2.25°C
30/07/11 07:57	2.375°C
30/07/11 08:07	2.375°C
30/07/11 08:17	2.5°C
30/07/11 08:27	2.625°C
30/07/11 08:37	2.25°C
30/07/11 08:47	1.5°C
30/07/11 08:57	1°C
30/07/11 09:07	1°C
30/07/11 09:17	1.125°C
30/07/11 09:27	1.125°C
30/07/11 09:37	1°C
30/07/11 09:47	1°C
30/07/11 09:57	1°C
30/07/11 10:07	0.75°C
30/07/11 10:17	0.25°C
30/07/11 10:27	0.125°C
30/07/11 10:37	0.625°C
30/07/11 10:47	0.75°C
30/07/11 10:57	0.875°C
30/07/11 11:07	0.875°C
30/07/11 11:17	0.875°C
30/07/11 11:27	0.625°C
30/07/11 11:37	0.625°C
30/07/11 11:47	0.75°C
30/07/11 11:57	0.75°C
30/07/11 12:07	0.875°C
30/07/11 12:17	0.875°C
30/07/11 12:27	0.875°C
30/07/11 12:37	1°C
30/07/11 12:47	1.125°C
30/07/11 12:57	1.125°C
30/07/11 13:07	1.25°C
30/07/11 13:17	1.375°C
30/07/11 13:27	1.5°C
30/07/11 13:37	1.625°C
30/07/11 13:47	1.625°C
30/07/11 13:57	1.75°C
30/07/11 14:07	1.875°C
30/07/11 14:17	2°C
30/07/11 14:27	2.125°C
30/07/11 14:37	2.125°C
30/07/11 14:47	2.25°C

Table B2contd: Environmental temperature recording along Supply Chain 2

Date	Temperature Reading
30/07/11 14:57	2.375°C
30/07/11 15:07	2.375°C
30/07/11 15:17	2.5°C
30/07/11 15:27	2.5°C
30/07/11 15:37	2.625°C
30/07/11 15:47	2.625°C
30/07/11 15:57	2.75°C
30/07/11 16:07	2.75°C
30/07/11 16:17	2.875°C
30/07/11 16:27	3°C
30/07/11 16:37	3°C
30/07/11 16:47	3.125°C
30/07/11 16:57	3.125°C
30/07/11 17:07	3.375°C
30/07/11 17:17	2.75°C
30/07/11 17:27	1.875°C
30/07/11 17:37	1.625°C
30/07/11 17:47	1.5°C
30/07/11 17:57	1.625°C
30/07/11 18:07	1.625°C
30/07/11 18:17	1.125°C
30/07/11 18:27	0.75°C
30/07/11 18:37	0.75°C
30/07/11 18:47	0.875°C
30/07/11 18:57	1°C
30/07/11 19:07	1.125°C
30/07/11 19:17	1.25°C
30/07/11 19:27	1.375°C
30/07/11 19:37	1.5°C
30/07/11 19:47	1.625°C
30/07/11 19:57	1.75°C
30/07/11 20:07	1.625°C
30/07/11 20:17	1.625°C
30/07/11 20:27	1.5°C
30/07/11 20:37	1.5°C
30/07/11 20:47	1.5°C
30/07/11 20:57	1.375°C
30/07/11 21:07	1.5°C
30/07/11 21:17	1.5°C
30/07/11 21:27	1.5°C
30/07/11 21:37	1.5°C
30/07/11 21:47	1.375°C
30/07/11 21:57	1.375°C
30/07/11 22:07	1.25°C
30/07/11 22:17	1.375°C
30/07/11 22:27	1.5°C
30/07/11 22:37	1.5°C
30/07/11 22:47	1.75°C
30/07/11 22:57	1.75°C
30/07/11 23:07	2.125°C
30/07/11 23:17	2.375°C
30/07/11 23:27	2.375°C
30/07/11 23:37	2.375°C
30/07/11 23:47	2.5°C
30/07/11 23:57	2.625°C
31/07/11 00:07	2.625°C
31/07/11 00:17	2.75°C
31/07/11 00:27	2.875°C

Date	Temperature Reading
31/07/11 00:37	2.875°C
31/07/11 00:47	3°C
31/07/11 00:57	3°C
31/07/11 01:07	3°C
31/07/11 01:17	3°C
31/07/11 01:27	3°C
31/07/11 01:37	3°C
31/07/11 01:47	2.375°C
31/07/11 01:57	2°C
31/07/11 02:07	1.875°C
31/07/11 02:17	1.625°C
31/07/11 02:27	1.625°C
31/07/11 02:37	1.625°C
31/07/11 02:47	1.625°C
31/07/11 02:57	1.625°C
31/07/11 03:07	1.75°C
31/07/11 03:17	1.75°C
31/07/11 03:27	1.75°C
31/07/11 03:37	1.75°C
31/07/11 03:47	1.875°C
31/07/11 03:57	2°C
31/07/11 04:07	2.125°C
31/07/11 04:17	2.125°C
31/07/11 04:27	2.25°C
31/07/11 04:37	2.25°C
31/07/11 04:47	2.375°C
31/07/11 04:57	2.5°C
31/07/11 05:07	2.625°C
31/07/11 05:17	2.625°C
31/07/11 05:27	2.75°C
31/07/11 05:37	2.875°C
31/07/11 05:47	2.875°C
31/07/11 05:57	3°C
31/07/11 06:07	3°C
31/07/11 06:17	3.125°C
31/07/11 06:27	3.25°C
31/07/11 06:37	3.25°C
31/07/11 06:47	3.25°C
31/07/11 06:57	3.375°C
31/07/11 07:07	3.375°C
31/07/11 07:17	3.375°C
31/07/11 07:27	3.125°C
31/07/11 07:37	2.625°C
31/07/11 07:47	2.375°C
31/07/11 07:57	2.25°C
31/07/11 08:07	2.125°C
31/07/11 08:17	2.125°C
31/07/11 08:27	2.125°C
31/07/11 08:37	2.25°C
31/07/11 08:47	2.25°C
31/07/11 08:57	2.25°C
31/07/11 09:07	2.375°C
31/07/11 09:17	2.5°C
31/07/11 09:27	2.625°C
31/07/11 09:37	2.75°C
31/07/11 09:47	2.875°C
31/07/11 09:57	2.875°C
31/07/11 10:07	3°C

Table B2contd: Environmental temperature recording along Supply Chain 2

Date	Temperature Reading
31/07/11 10:17	3°C
31/07/11 10:27	3.125°C
31/07/11 10:37	3.125°C
31/07/11 10:47	3.25°C
31/07/11 10:57	3.25°C
31/07/11 11:07	3.25°C
31/07/11 11:17	3°C
31/07/11 11:27	2.875°C
31/07/11 11:37	2.875°C
31/07/11 11:47	2.875°C
31/07/11 11:57	3°C
31/07/11 12:07	3°C
31/07/11 12:17	3.125°C
31/07/11 12:27	3.25°C
31/07/11 12:37	3.125°C
31/07/11 12:47	3.25°C
31/07/11 12:57	2.75°C
31/07/11 13:07	2.625°C
31/07/11 13:17	2.5°C
31/07/11 13:27	2.375°C
31/07/11 13:37	2.375°C
31/07/11 13:47	2.375°C
31/07/11 13:57	2.375°C
31/07/11 14:07	2.375°C
31/07/11 14:17	2.5°C
31/07/11 14:27	2.625°C
31/07/11 14:37	2.75°C
31/07/11 14:47	2.75°C
31/07/11 14:57	2.625°C
31/07/11 15:07	2.75°C
31/07/11 15:17	2.625°C
31/07/11 15:27	2.625°C
31/07/11 15:37	2.625°C
31/07/11 15:47	2.75°C
31/07/11 15:57	2.75°C
31/07/11 16:07	2.875°C
31/07/11 16:17	2.875°C
31/07/11 16:27	3°C
31/07/11 16:37	3.125°C
31/07/11 16:47	3.125°C
31/07/11 16:57	3°C
31/07/11 17:07	2.875°C
31/07/11 17:17	2.75°C
31/07/11 17:27	2.625°C
31/07/11 17:37	2.625°C
31/07/11 17:47	2.5°C
31/07/11 17:57	2.5°C
31/07/11 18:07	2.375°C
31/07/11 18:17	2.125°C
31/07/11 18:27	2.125°C
31/07/11 18:37	2.125°C
31/07/11 18:47	2.125°C
31/07/11 18:57	2.125°C
31/07/11 19:07	2.125°C
31/07/11 19:17	2.125°C
31/07/11 19:27	2.125°C
31/07/11 19:37	2.25°C
31/07/11 19:47	2.375°C

Date	Temperature Reading
31/07/11 19:57	2.375°C
31/07/11 20:07	2.5°C
31/07/11 20:17	2.5°C
31/07/11 20:27	2.5°C
31/07/11 20:37	2.5°C
31/07/11 20:47	2.75°C
31/07/11 20:57	3°C
31/07/11 21:07	3°C
31/07/11 21:17	3.125°C
31/07/11 21:27	3.25°C
31/07/11 21:37	3.25°C
31/07/11 21:47	3.25°C
31/07/11 21:57	3.25°C
31/07/11 22:07	2.5°C
31/07/11 22:17	2.125°C
31/07/11 22:27	1.75°C
31/07/11 22:37	1.625°C
31/07/11 22:47	1.625°C
31/07/11 22:57	1.625°C
31/07/11 23:07	1.625°C
31/07/11 23:17	1.625°C
31/07/11 23:27	1.75°C
31/07/11 23:37	1.75°C
31/07/11 23:47	1.75°C
31/07/11 23:57	1.875°C
1/8/2011 0:07	2°C
1/8/2011 0:17	2.125°C
1/8/2011 0:27	2.25°C
1/8/2011 0:37	2.375°C
1/8/2011 0:47	2.375°C
1/8/2011 0:57	2.5°C
1/8/2011 1:07	2.625°C
1/8/2011 1:17	2.75°C
1/8/2011 1:27	2.875°C
1/8/2011 1:37	2.875°C
1/8/2011 1:47	3°C
1/8/2011 1:57	3.125°C
1/8/2011 2:07	3°C
1/8/2011 2:17	2.875°C
1/8/2011 2:27	2.75°C
1/8/2011 2:37	2.625°C
1/8/2011 2:47	2.625°C
1/8/2011 2:57	2.625°C
1/8/2011 3:07	2.625°C
1/8/2011 3:17	2.75°C
1/8/2011 3:27	2.875°C
1/8/2011 3:37	2.875°C
1/8/2011 3:47	2.5°C
1/8/2011 3:57	2.25°C
1/8/2011 4:07	2.125°C
1/8/2011 4:17	2.125°C
1/8/2011 4:27	2.25°C
1/8/2011 4:37	2.25°C
1/8/2011 4:47	2.25°C
1/8/2011 4:57	2.375°C
1/8/2011 5:07	2.375°C
1/8/2011 5:17	2.5°C
1/8/2011 5:27	2.625°C

Table B2$_{contd}$: Environmental temperature recording along Supply Chain 2

Date	Temperature Reading
1/8/2011 5:37	2.625°C
1/8/2011 5:47	2.75°C
1/8/2011 5:57	2.875°C
1/8/2011 6:07	2.875°C
1/8/2011 6:17	3°C
1/8/2011 6:27	3°C
1/8/2011 6:37	2.875°C
1/8/2011 6:47	2.75°C
1/8/2011 6:57	2.75°C
1/8/2011 7:07	2.75°C
1/8/2011 7:17	2.75°C
1/8/2011 7:27	2.875°C
1/8/2011 7:37	2.875°C
1/8/2011 7:47	3°C
1/8/2011 7:57	2.875°C
1/8/2011 8:07	3°C
1/8/2011 8:17	3.125°C
1/8/2011 8:27	3.125°C
1/8/2011 8:37	3.25°C
1/8/2011 8:47	3.25°C
1/8/2011 8:57	3.375°C
1/8/2011 9:07	3°C
1/8/2011 9:17	2.5°C
1/8/2011 9:27	2.25°C
1/8/2011 9:37	2.125°C
1/8/2011 9:47	2°C
1/8/2011 9:57	2°C
1/8/2011 10:07	1.875°C
1/8/2011 10:17	1.75°C
1/8/2011 10:27	1.75°C
1/8/2011 10:37	1.75°C
1/8/2011 10:47	1.875°C
1/8/2011 10:57	1.875°C
1/8/2011 11:07	2°C
1/8/2011 11:17	2°C
1/8/2011 11:27	2.125°C
1/8/2011 11:37	2.25°C
1/8/2011 11:47	2.25°C
1/8/2011 11:57	2.375°C
1/8/2011 12:07	2.5°C
1/8/2011 12:17	2.5°C
1/8/2011 12:27	2.5°C
1/8/2011 12:37	2.75°C
1/8/2011 12:47	2.75°C
1/8/2011 12:57	2.625°C
1/8/2011 13:07	2.25°C
1/8/2011 13:17	1.75°C
1/8/2011 13:27	1.5°C
1/8/2011 13:37	1.375°C
1/8/2011 13:47	1.375°C
1/8/2011 13:57	1.25°C
1/8/2011 14:07	1.375°C
1/8/2011 14:17	1.5°C
1/8/2011 14:27	1.5°C
1/8/2011 14:37	1.625°C
1/8/2011 14:47	1.75°C
1/8/2011 14:57	1.875°C
1/8/2011 15:07	2.875°C

Date	Temperature Reading
1/8/2011 15:17	2.75°C
1/8/2011 15:27	2.75°C
1/8/2011 15:37	2.875°C
1/8/2011 15:47	3°C
1/8/2011 15:57	3°C
1/8/2011 16:07	3.125°C
1/8/2011 16:17	3.25°C
1/8/2011 16:27	3.375°C
1/8/2011 16:37	3.375°C
1/8/2011 16:47	3.5°C
1/8/2011 16:57	3.5°C
1/8/2011 17:07	3.625°C
1/8/2011 17:17	3.625°C
1/8/2011 17:27	3.75°C
1/8/2011 17:37	3.75°C
1/8/2011 17:47	3.875°C
1/8/2011 17:57	3.875°C
1/8/2011 18:07	3.875°C
1/8/2011 18:17	4°C
1/8/2011 18:27	4°C
1/8/2011 18:37	3.625°C
1/8/2011 18:47	3.25°C
1/8/2011 18:57	2.625°C
1/8/2011 19:07	2°C
1/8/2011 19:17	1.5°C
1/8/2011 19:27	1.25°C
1/8/2011 19:37	1°C
1/8/2011 19:47	1°C
1/8/2011 19:57	1.375°C
1/8/2011 20:07	1.5°C
1/8/2011 20:17	1.625°C
1/8/2011 20:27	1.625°C
1/8/2011 20:37	1.625°C
1/8/2011 20:47	1.75°C
1/8/2011 20:57	1.875°C
1/8/2011 21:07	2°C
1/8/2011 21:17	2.125°C
1/8/2011 21:27	2.25°C
1/8/2011 21:37	2.25°C
1/8/2011 21:47	2.25°C
1/8/2011 21:57	2.25°C
1/8/2011 22:07	2.375°C
1/8/2011 22:17	2.5°C
1/8/2011 22:27	2.125°C
1/8/2011 22:37	2°C
1/8/2011 22:47	1.875°C
1/8/2011 22:57	2°C
1/8/2011 23:07	2°C
1/8/2011 23:17	2°C
1/8/2011 23:27	2.125°C
1/8/2011 23:37	2.375°C
1/8/2011 23:47	2.5°C
1/8/2011 23:57	2.5°C
2/8/2011 0:07	2.625°C
2/8/2011 0:17	2.75°C
2/8/2011 0:27	2.875°C
2/8/2011 0:37	3°C
2/8/2011 0:47	3.125°C

Table B2$_{contd}$: Environmental temperature recording along Supply Chain 2

Date	Temperature Reading
2/8/2011 0:57	3.25°C
2/8/2011 1:07	3.125°C
2/8/2011 1:17	2.125°C
2/8/2011 1:27	1.75°C
2/8/2011 1:37	1.625°C
2/8/2011 1:47	1.625°C
2/8/2011 1:57	1.5°C
2/8/2011 2:07	1.625°C
2/8/2011 2:17	1.625°C
2/8/2011 2:27	1.75°C
2/8/2011 2:37	1.75°C
2/8/2011 2:47	1.875°C
2/8/2011 2:57	2°C
2/8/2011 3:07	2.25°C
2/8/2011 3:17	2.25°C
2/8/2011 3:27	2.5°C
2/8/2011 3:37	2.75°C
2/8/2011 3:47	2.875°C
2/8/2011 3:57	3°C
2/8/2011 4:07	3°C
2/8/2011 4:17	3.25°C
2/8/2011 4:27	3.25°C
2/8/2011 4:37	3.375°C
2/8/2011 4:47	2.875°C
2/8/2011 4:57	2.375°C
2/8/2011 5:07	2.25°C
2/8/2011 5:17	2.25°C
2/8/2011 5:27	2.125°C
2/8/2011 5:37	2.125°C
2/8/2011 5:47	2.25°C
2/8/2011 5:57	2.375°C
2/8/2011 6:07	2.5°C
2/8/2011 6:17	2.625°C
2/8/2011 6:27	2.75°C
2/8/2011 6:37	2.75°C
2/8/2011 6:47	2.875°C
2/8/2011 6:57	2.625°C
2/8/2011 7:07	2.375°C
2/8/2011 7:17	1.625°C
2/8/2011 7:27	1.125°C
2/8/2011 7:37	0.875°C
2/8/2011 7:47	0.625°C
2/8/2011 7:57	0.5°C
2/8/2011 8:07	0.375°C
2/8/2011 8:17	0.25°C
2/8/2011 8:27	0.125°C
2/8/2011 8:37	0.125°C
2/8/2011 8:47	0.125°C
2/8/2011 8:57	0.25°C
2/8/2011 9:07	0.375°C
2/8/2011 9:17	0.5°C
2/8/2011 9:27	0.625°C
2/8/2011 9:37	0.625°C
2/8/2011 9:47	0.75°C
2/8/2011 9:57	0.75°C
2/8/2011 10:07	0.75°C
2/8/2011 10:17	0.375°C
2/8/2011 10:27	0.125°C

Date	Temperature Reading
2/8/2011 10:37	-0.125°C
2/8/2011 10:47	-0.125°C
2/8/2011 10:57	-0.125°C
2/8/2011 11:07	-0.125°C
2/8/2011 11:17	-0.25°C
2/8/2011 11:27	-0.375°C
2/8/2011 11:37	-0.5°C
2/8/2011 11:47	-0.5°C
2/8/2011 11:57	-0.5°C
2/8/2011 12:07	-0.5°C
2/8/2011 12:17	-0.5°C
2/8/2011 12:27	-0.625°C
2/8/2011 12:37	-0.75°C
2/8/2011 12:47	-0.75°C
2/8/2011 12:57	-0.75°C
2/8/2011 13:07	-0.75°C
2/8/2011 13:17	-0.625°C
2/8/2011 13:27	-0.625°C
2/8/2011 13:37	-0.625°C
2/8/2011 13:47	-0.625°C
2/8/2011 13:57	-0.625°C
2/8/2011 14:07	-0.875°C
2/8/2011 14:17	-1°C
2/8/2011 14:27	-1.25°C
2/8/2011 14:37	-1.25°C
2/8/2011 14:47	-1.375°C
2/8/2011 14:57	-1.375°C
2/8/2011 15:07	-1.375°C
2/8/2011 15:17	-1.375°C
2/8/2011 15:27	0.375°C
2/8/2011 15:37	0.75°C
2/8/2011 15:47	1.125°C
2/8/2011 15:57	1.375°C
2/8/2011 16:07	1.75°C
2/8/2011 16:17	2.375°C
2/8/2011 16:27	3°C
2/8/2011 16:37	3.75°C
2/8/2011 16:47	4.375°C
2/8/2011 16:57	5°C
2/8/2011 17:07	5.25°C
2/8/2011 17:17	5.75°C
2/8/2011 17:27	6.25°C
2/8/2011 17:37	6.75°C
2/8/2011 17:47	7.125°C
2/8/2011 17:57	7.375°C
2/8/2011 18:07	8.25°C
2/8/2011 18:17	8.625°C
2/8/2011 18:27	9.125°C
2/8/2011 18:37	9.5°C
2/8/2011 18:47	9.875°C
2/8/2011 18:57	10.25°C
2/8/2011 19:07	10.625°C
2/8/2011 19:17	11°C
2/8/2011 19:27	11.375°C
2/8/2011 19:37	11.625°C
2/8/2011 19:47	12°C
2/8/2011 19:57	12.25°C
2/8/2011 20:07	12.625°C

Table B2$_{contd}$: Environmental temperature recording along Supply Chain 2

Date	Temperature Reading
2/8/2011 20:17	12.875°C
2/8/2011 20:27	13.125°C
2/8/2011 20:37	13.375°C
2/8/2011 20:47	13.625°C
2/8/2011 20:57	14°C
2/8/2011 21:07	14.25°C
2/8/2011 21:17	14.5°C
2/8/2011 21:27	14.625°C
2/8/2011 21:37	14.875°C
2/8/2011 21:47	15.125°C
2/8/2011 21:57	15.375°C
2/8/2011 22:07	15.5°C
2/8/2011 22:17	15.75°C
2/8/2011 22:27	16°C
2/8/2011 22:37	16.25°C
2/8/2011 22:47	16.375°C
2/8/2011 22:57	16.625°C
2/8/2011 23:07	16.875°C
2/8/2011 23:17	17°C
2/8/2011 23:27	17.25°C
2/8/2011 23:37	17.375°C
2/8/2011 23:47	17.625°C
2/8/2011 23:57	17.75°C
3/8/2011 0:07	18°C
3/8/2011 0:17	18.125°C
3/8/2011 0:27	18.375°C
3/8/2011 0:37	18.5°C
3/8/2011 0:47	18.625°C
3/8/2011 0:57	18.875°C
3/8/2011 1:07	19°C
3/8/2011 1:17	19.25°C
3/8/2011 1:27	19.375°C
3/8/2011 1:37	19.5°C
3/8/2011 1:47	19.625°C
3/8/2011 1:57	19.875°C
3/8/2011 2:07	20°C
3/8/2011 2:17	20.125°C
3/8/2011 2:27	20.25°C
3/8/2011 2:37	20.375°C
3/8/2011 2:47	20.625°C
3/8/2011 2:57	20.75°C
3/8/2011 3:07	20.875°C
3/8/2011 3:17	21°C
3/8/2011 3:27	21.125°C
3/8/2011 3:37	21.25°C
3/8/2011 3:47	21.375°C
3/8/2011 3:57	21.5°C
3/8/2011 4:07	21.625°C
3/8/2011 4:17	21.75°C
3/8/2011 4:27	21.875°C
3/8/2011 4:37	22°C
3/8/2011 4:47	22°C
3/8/2011 4:57	22.125°C
3/8/2011 5:07	22.25°C
3/8/2011 5:17	22.375°C
3/8/2011 5:27	22.5°C
3/8/2011 5:37	22.5°C
3/8/2011 5:47	22.625°C

Date	Temperature Reading
3/8/2011 5:57	22.75°C
3/8/2011 6:07	22.875°C
3/8/2011 6:17	22.875°C
3/8/2011 6:27	23°C
3/8/2011 6:37	23.125°C
3/8/2011 6:47	23.125°C
3/8/2011 6:57	23.25°C
3/8/2011 7:07	23.375°C
3/8/2011 7:17	23.375°C
3/8/2011 7:27	23.5°C
3/8/2011 7:37	23.625°C
3/8/2011 7:47	23.625°C
3/8/2011 7:57	23.75°C
3/8/2011 8:07	23.75°C
3/8/2011 8:17	23.875°C
3/8/2011 8:27	23.875°C
3/8/2011 8:37	24°C
3/8/2011 8:47	24°C
3/8/2011 8:57	24°C
3/8/2011 9:07	24.125°C
3/8/2011 9:17	24.125°C
3/8/2011 9:27	24.25°C
3/8/2011 9:37	24.25°C
3/8/2011 9:47	24.375°C
3/8/2011 9:57	24.375°C
3/8/2011 10:07	24.5°C
3/8/2011 10:17	24.5°C
3/8/2011 10:27	24.5°C
3/8/2011 10:37	24.625°C
3/8/2011 10:47	24.625°C
3/8/2011 10:57	24.625°C
3/8/2011 11:07	24.75°C
3/8/2011 11:17	24.75°C
3/8/2011 11:27	24.875°C
3/8/2011 11:37	24.875°C
3/8/2011 11:47	24.875°C
3/8/2011 11:57	24.875°C
3/8/2011 12:07	25°C
3/8/2011 12:17	25°C
3/8/2011 12:27	25°C
3/8/2011 12:37	25.125°C
3/8/2011 12:47	25.125°C
3/8/2011 12:57	25.125°C
3/8/2011 13:07	25.25°C
3/8/2011 13:17	25.25°C
3/8/2011 13:27	25.25°C
3/8/2011 13:37	25.25°C
3/8/2011 13:47	25.375°C
3/8/2011 13:57	25.375°C
3/8/2011 14:07	25.375°C
3/8/2011 14:17	25.375°C
3/8/2011 14:27	25.5°C
3/8/2011 14:37	25.5°C
3/8/2011 14:47	25.5°C
3/8/2011 14:57	25.5°C
3/8/2011 15:07	25.625°C
3/8/2011 15:17	25.625°C
3/8/2011 15:27	25.625°C

Table B2$_{contd}$: Environmental temperature recording along Supply Chain 2

Date	Temperature Reading
3/8/2011 15:37	25.625°C
3/8/2011 15:47	25.625°C
3/8/2011 15:57	25.75°C
3/8/2011 16:07	25.75°C
3/8/2011 16:17	25.75°C
3/8/2011 16:27	25.75°C
3/8/2011 16:37	25.75°C
3/8/2011 16:47	25.875°C
3/8/2011 16:57	25.875°C
3/8/2011 17:07	25.875°C
3/8/2011 17:17	25.875°C
3/8/2011 17:27	25.875°C
3/8/2011 17:37	26°C
3/8/2011 17:47	26°C
3/8/2011 17:57	26°C
3/8/2011 18:07	26°C
3/8/2011 18:17	26°C
3/8/2011 18:27	26°C
3/8/2011 18:37	26°C
3/8/2011 18:47	26.125°C
3/8/2011 18:57	26.125°C
3/8/2011 19:07	26.125°C
3/8/2011 19:17	26.125°C
3/8/2011 19:27	26.125°C
3/8/2011 19:37	26.125°C
3/8/2011 19:47	26.25°C
3/8/2011 19:57	26.25°C
3/8/2011 20:07	26.25°C
3/8/2011 20:17	26.25°C
3/8/2011 20:27	26.25°C
3/8/2011 20:37	26.25°C
3/8/2011 20:47	26.25°C
3/8/2011 20:57	26.25°C
3/8/2011 21:07	26.375°C
3/8/2011 21:17	26.375°C
3/8/2011 21:27	26.375°C
3/8/2011 21:37	26.375°C
3/8/2011 21:47	26.375°C
3/8/2011 21:57	26.375°C
3/8/2011 22:07	26.375°C
3/8/2011 22:17	26.375°C
3/8/2011 22:27	26.375°C
3/8/2011 22:37	26.375°C
3/8/2011 22:47	26.375°C
3/8/2011 22:57	26.375°C
3/8/2011 23:07	26.375°C
3/8/2011 23:17	26.375°C
3/8/2011 23:27	26.375°C
3/8/2011 23:37	26.375°C
3/8/2011 23:47	26.375°C
3/8/2011 23:57	26.375°C
4/8/2011 0:07	26.375°C
4/8/2011 0:17	26.375°C
4/8/2011 0:27	26.375°C
4/8/2011 0:37	26.375°C
4/8/2011 0:47	26.375°C
4/8/2011 0:57	26.375°C
4/8/2011 1:07	26.375°C
4/8/2011 1:17	26.375°C
4/8/2011 1:27	26.375°C
4/8/2011 1:37	26.375°C
4/8/2011 1:47	26.375°C
4/8/2011 1:57	26.375°C
4/8/2011 2:07	26.375°C
4/8/2011 2:17	26.375°C
4/8/2011 2:27	26.375°C
4/8/2011 2:37	26.375°C
4/8/2011 2:47	26.375°C
4/8/2011 2:57	26.375°C
4/8/2011 3:07	26.375°C
4/8/2011 3:17	26.375°C
4/8/2011 3:27	26.375°C
4/8/2011 3:37	26.375°C
4/8/2011 3:47	26.375°C
4/8/2011 3:57	26.375°C
4/8/2011 4:07	26.375°C
4/8/2011 4:17	26.375°C
4/8/2011 4:27	26.375°C
4/8/2011 4:37	26.375°C
4/8/2011 4:47	26.375°C
4/8/2011 4:57	26.375°C
4/8/2011 5:07	26.375°C
4/8/2011 5:17	26.375°C
4/8/2011 5:27	26.375°C
4/8/2011 5:37	26.375°C
4/8/2011 5:47	26.375°C
4/8/2011 5:57	26.375°C
4/8/2011 6:07	26.375°C
4/8/2011 6:17	26.375°C
4/8/2011 6:27	26.375°C
4/8/2011 6:37	26.375°C
4/8/2011 6:47	26.375°C
4/8/2011 6:57	26.375°C
4/8/2011 7:07	26.375°C
4/8/2011 7:17	26.375°C
4/8/2011 7:27	26.375°C
4/8/2011 7:37	26.375°C
4/8/2011 7:47	26.375°C
4/8/2011 7:57	26.375°C
4/8/2011 8:07	26.375°C
4/8/2011 8:17	26.375°C
4/8/2011 8:27	26.375°C
4/8/2011 8:37	26.375°C
4/8/2011 8:47	26.375°C
4/8/2011 8:57	26.375°C
4/8/2011 9:07	26.375°C

B3: Temperature recordings along Supply Chain 3

Table B3: Environmental temperature reading along Supply Chain 3

Date	Temperature Reading
3/8/2011 16:45	0.875°C
3/8/2011 16:55	1°C
3/8/2011 17:05	1°C
3/8/2011 17:15	1.125°C
3/8/2011 17:25	1°C
3/8/2011 17:35	0.875°C
3/8/2011 17:45	0.875°C
3/8/2011 17:55	1.125°C
3/8/2011 18:05	0.75°C
3/8/2011 18:15	0.75°C
3/8/2011 18:25	0.875°C
3/8/2011 18:35	1°C
3/8/2011 18:45	1.125°C
3/8/2011 18:55	1.125°C
3/8/2011 19:05	1.25°C
3/8/2011 19:15	1.25°C
3/8/2011 19:25	1.375°C
3/8/2011 19:35	1.375°C
3/8/2011 19:45	1.5°C
3/8/2011 19:55	1.5°C
3/8/2011 20:05	1.625°C
3/8/2011 20:15	1.625°C
3/8/2011 20:25	1.75°C
3/8/2011 20:35	2.125°C
3/8/2011 20:45	2.375°C
3/8/2011 20:55	2.75°C
3/8/2011 21:05	3°C
3/8/2011 21:15	3.25°C
3/8/2011 21:25	3°C
3/8/2011 21:35	2.875°C
3/8/2011 21:45	2.875°C
3/8/2011 21:55	2.875°C
3/8/2011 22:05	2.875°C
3/8/2011 22:15	2.75°C
3/8/2011 22:25	2.625°C
3/8/2011 22:35	2.25°C
3/8/2011 22:45	2°C

Date	Temperature Reading
3/8/2011 22:55	1.875°C
3/8/2011 23:05	1.75°C
3/8/2011 23:15	1.625°C
3/8/2011 23:25	1.5°C
3/8/2011 23:35	1.375°C
3/8/2011 23:45	1.375°C
3/8/2011 23:55	1.5°C
4/8/2011 0:05	1.375°C
4/8/2011 0:15	1.375°C
4/8/2011 0:25	1.375°C
4/8/2011 0:35	1.25°C
4/8/2011 0:45	1.25°C
4/8/2011 0:55	1.375°C
4/8/2011 1:05	1.25°C
4/8/2011 1:15	1.25°C
4/8/2011 1:25	1.375°C
4/8/2011 1:35	1.125°C
4/8/2011 1:45	1.125°C
4/8/2011 1:55	1.25°C
4/8/2011 2:05	1°C
4/8/2011 2:15	1.125°C
4/8/2011 2:25	1.25°C
4/8/2011 2:35	1°C
4/8/2011 2:45	1°C
4/8/2011 2:55	1.125°C
4/8/2011 3:05	1.25°C
4/8/2011 3:15	1.375°C
4/8/2011 3:25	1.5°C
4/8/2011 3:35	1.625°C
4/8/2011 3:45	1.625°C
4/8/2011 3:55	1.75°C
4/8/2011 4:05	1.75°C
4/8/2011 4:15	1.875°C
4/8/2011 4:25	1.875°C
4/8/2011 4:35	2°C
4/8/2011 4:45	2°C
4/8/2011 4:55	2.125°C
4/8/2011 5:05	2.125°C

Table B3contd: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
4/8/2011 5:15	2.25°C
4/8/2011 5:25	2.25°C
4/8/2011 5:35	2.25°C
4/8/2011 5:45	2.375°C
4/8/2011 5:55	2.375°C
4/8/2011 6:05	2.375°C
4/8/2011 6:15	2.5°C
4/8/2011 6:25	2.5°C
4/8/2011 6:35	2.5°C
4/8/2011 6:45	2.625°C
4/8/2011 6:55	2.625°C
4/8/2011 7:05	2.625°C
4/8/2011 7:15	2.25°C
4/8/2011 7:25	2.125°C
4/8/2011 7:35	2°C
4/8/2011 7:45	2°C
4/8/2011 7:55	1.75°C
4/8/2011 8:05	1.625°C
4/8/2011 8:15	1.625°C
4/8/2011 8:25	1.625°C
4/8/2011 8:35	1.5°C
4/8/2011 8:45	1.5°C
4/8/2011 8:55	1.5°C
4/8/2011 9:05	1.375°C
4/8/2011 9:15	1.5°C
4/8/2011 9:25	1.25°C
4/8/2011 9:35	1.375°C
4/8/2011 9:45	1.5°C
4/8/2011 9:55	1.25°C
4/8/2011 10:05	1.25°C
4/8/2011 10:15	1.375°C
4/8/2011 10:25	1.25°C
4/8/2011 10:35	1.25°C
4/8/2011 10:45	1.25°C
4/8/2011 10:55	1.375°C
4/8/2011 11:05	1.125°C
4/8/2011 11:15	1.125°C
4/8/2011 11:25	1.25°C
4/8/2011 11:35	1.125°C
4/8/2011 11:45	1.125°C

Date	Temperature Reading
4/8/2011 11:55	1.125°C
4/8/2011 12:05	1.125°C
4/8/2011 12:15	1°C
4/8/2011 12:25	1°C
4/8/2011 12:35	1.125°C
4/8/2011 12:45	1°C
4/8/2011 12:55	1°C
4/8/2011 13:05	1.125°C
4/8/2011 13:15	1.125°C
4/8/2011 13:25	1.125°C
4/8/2011 13:35	1.125°C
4/8/2011 13:45	1.25°C
4/8/2011 13:55	1.25°C
4/8/2011 14:05	1.25°C
4/8/2011 14:15	1.25°C
4/8/2011 14:25	1.25°C
4/8/2011 14:35	1.25°C
4/8/2011 14:45	1.25°C
4/8/2011 14:55	1.25°C
4/8/2011 15:05	1.25°C
4/8/2011 15:15	1.25°C
4/8/2011 15:25	1.25°C
4/8/2011 15:35	1.25°C
4/8/2011 15:45	1.25°C
4/8/2011 15:55	1.25°C
4/8/2011 16:05	1.25°C
4/8/2011 16:15	1.25°C
4/8/2011 16:25	1.25°C
4/8/2011 16:35	1.25°C
4/8/2011 16:45	1.25°C
4/8/2011 16:55	1.375°C
4/8/2011 17:05	1.25°C
4/8/2011 17:15	1.25°C
4/8/2011 17:25	1.25°C
4/8/2011 17:35	1.25°C
4/8/2011 17:45	1.25°C
4/8/2011 17:55	1.25°C
4/8/2011 18:05	1.25°C
4/8/2011 18:15	1.25°C
4/8/2011 18:25	1.375°C

Table B3contd: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
4/8/2011 18:35	1.375°C
4/8/2011 18:45	1.375°C
4/8/2011 18:55	1.375°C
4/8/2011 19:05	1.375°C
4/8/2011 19:15	1.375°C
4/8/2011 19:25	1.375°C
4/8/2011 19:35	1.375°C
4/8/2011 19:45	1.375°C
4/8/2011 19:55	1.375°C
4/8/2011 20:05	1.375°C
4/8/2011 20:15	1.375°C
4/8/2011 20:25	1.375°C
4/8/2011 20:35	1.5°C
4/8/2011 20:45	1.5°C
4/8/2011 20:55	1.5°C
4/8/2011 21:05	1.5°C
4/8/2011 21:15	1.5°C
4/8/2011 21:25	1.5°C
4/8/2011 21:35	1.5°C
4/8/2011 21:45	1.5°C
4/8/2011 21:55	1.5°C
4/8/2011 22:05	1.625°C
4/8/2011 22:15	1.625°C
4/8/2011 22:25	1.625°C
4/8/2011 22:35	1.625°C
4/8/2011 22:45	1.625°C
4/8/2011 22:55	1.625°C
4/8/2011 23:05	1.625°C
4/8/2011 23:15	1.625°C
4/8/2011 23:25	1.625°C
4/8/2011 23:35	1.625°C
4/8/2011 23:45	1.625°C
4/8/2011 23:55	1.625°C
5/8/2011 0:05	1.625°C
5/8/2011 0:15	1.625°C
5/8/2011 0:25	1.625°C
5/8/2011 0:35	1.625°C
5/8/2011 0:45	1.625°C
5/8/2011 0:55	1.625°C
5/8/2011 1:05	1.75°C
5/8/2011 1:15	1.625°C
5/8/2011 1:25	1.625°C
5/8/2011 1:35	1.625°C
5/8/2011 1:45	1.625°C
5/8/2011 1:55	1.75°C
5/8/2011 2:05	1.75°C
5/8/2011 2:15	1.625°C
5/8/2011 2:25	1.625°C
5/8/2011 2:35	1.625°C
5/8/2011 2:45	1.625°C
5/8/2011 2:55	1.625°C
5/8/2011 3:05	1.625°C
5/8/2011 3:15	1.625°C
5/8/2011 3:25	1.625°C
5/8/2011 3:35	1.625°C
5/8/2011 3:45	1.625°C
5/8/2011 3:55	1.625°C
5/8/2011 4:05	1.625°C
5/8/2011 4:15	1.625°C
5/8/2011 4:25	1.625°C
5/8/2011 4:35	1.625°C
5/8/2011 4:45	1.625°C
5/8/2011 4:55	1.625°C
5/8/2011 5:05	1.625°C
5/8/2011 5:15	1.625°C
5/8/2011 5:25	1.625°C
5/8/2011 5:35	1.625°C
5/8/2011 5:45	1.625°C
5/8/2011 5:55	1.625°C
5/8/2011 6:05	1.625°C
5/8/2011 6:15	1.625°C
5/8/2011 6:25	1.625°C
5/8/2011 6:35	1.5°C
5/8/2011 6:45	1.625°C
5/8/2011 6:55	1.625°C
5/8/2011 7:05	1.625°C
5/8/2011 7:15	1.625°C
5/8/2011 7:25	1.625°C
5/8/2011 7:35	1.625°C
5/8/2011 7:45	1.625°C

Table B3contd: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading	Date	Temperature Reading
5/8/2011 7:55	1.625°C	5/8/2011 14:35	2°C
5/8/2011 8:05	1.625°C	5/8/2011 14:45	2°C
5/8/2011 8:15	1.625°C	5/8/2011 14:55	2°C
5/8/2011 8:25	1.625°C	5/8/2011 15:05	2°C
5/8/2011 8:35	1.625°C	5/8/2011 15:15	2°C
5/8/2011 8:45	1.625°C	5/8/2011 15:25	2°C
5/8/2011 8:55	1.625°C	5/8/2011 15:35	2°C
5/8/2011 9:05	1.625°C	5/8/2011 15:45	2°C
5/8/2011 9:15	1.625°C	5/8/2011 15:55	2°C
5/8/2011 9:25	1.625°C	5/8/2011 16:05	2°C
5/8/2011 9:35	1.625°C	5/8/2011 16:15	2°C
5/8/2011 9:45	1.625°C	5/8/2011 16:25	2°C
5/8/2011 9:55	1.75°C	5/8/2011 16:35	2°C
5/8/2011 10:05	1.75°C	5/8/2011 16:45	2°C
5/8/2011 10:15	1.75°C	5/8/2011 16:55	2°C
5/8/2011 10:25	1.75°C	5/8/2011 17:05	2°C
5/8/2011 10:35	1.75°C	5/8/2011 17:15	2°C
5/8/2011 10:45	1.75°C	5/8/2011 17:25	2°C
5/8/2011 10:55	1.75°C	5/8/2011 17:35	2°C
5/8/2011 11:05	1.75°C	5/8/2011 17:45	2°C
5/8/2011 11:15	1.75°C	5/8/2011 17:55	2°C
5/8/2011 11:25	1.875°C	5/8/2011 18:05	2°C
5/8/2011 11:35	1.875°C	5/8/2011 18:15	2°C
5/8/2011 11:45	1.875°C	5/8/2011 18:25	2°C
5/8/2011 11:55	1.875°C	5/8/2011 18:35	2°C
5/8/2011 12:05	1.875°C	5/8/2011 18:45	2°C
5/8/2011 12:15	1.875°C	5/8/2011 18:55	1.875°C
5/8/2011 12:25	1.875°C	5/8/2011 19:05	1.875°C
5/8/2011 12:35	1.875°C	5/8/2011 19:15	1.875°C
5/8/2011 12:45	2°C	5/8/2011 19:25	1.875°C
5/8/2011 12:55	2°C	5/8/2011 19:35	1.875°C
5/8/2011 13:05	2°C	5/8/2011 19:45	1.875°C
5/8/2011 13:15	2°C	5/8/2011 19:55	1.875°C
5/8/2011 13:25	2°C	5/8/2011 20:05	1.875°C
5/8/2011 13:35	2°C	5/8/2011 20:15	1.875°C
5/8/2011 13:45	2°C	5/8/2011 20:25	1.875°C
5/8/2011 13:55	2°C	5/8/2011 20:35	1.875°C
5/8/2011 14:05	2°C	5/8/2011 20:45	1.875°C
5/8/2011 14:15	2°C	5/8/2011 20:55	1.875°C
5/8/2011 14:25	2°C	5/8/2011 21:05	1.875°C

Table B3$_{contd}$: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
5/8/2011 21:15	1.875°C
5/8/2011 21:25	1.875°C
5/8/2011 21:35	1.875°C
5/8/2011 21:45	1.875°C
5/8/2011 21:55	1.875°C
5/8/2011 22:05	1.875°C
5/8/2011 22:15	1.875°C
5/8/2011 22:25	1.875°C
5/8/2011 22:35	1.875°C
5/8/2011 22:45	1.875°C
5/8/2011 22:55	1.875°C
5/8/2011 23:05	1.875°C
5/8/2011 23:15	1.875°C
5/8/2011 23:25	1.875°C
5/8/2011 23:35	1.875°C
5/8/2011 23:45	1.875°C
5/8/2011 23:55	1.875°C
6/8/2011 0:05	1.875°C
6/8/2011 0:15	1.875°C
6/8/2011 0:25	1.875°C
6/8/2011 0:35	1.875°C
6/8/2011 0:45	1.875°C
6/8/2011 0:55	1.875°C
6/8/2011 1:05	1.875°C
6/8/2011 1:15	1.875°C
6/8/2011 1:25	1.875°C
6/8/2011 1:35	1.875°C
6/8/2011 1:45	1.875°C
6/8/2011 1:55	1.875°C
6/8/2011 2:05	1.875°C
6/8/2011 2:15	1.875°C
6/8/2011 2:25	1.875°C
6/8/2011 2:35	1.875°C
6/8/2011 2:45	1.875°C
6/8/2011 2:55	1.875°C
6/8/2011 3:05	1.875°C
6/8/2011 3:15	1.875°C
6/8/2011 3:25	1.875°C
6/8/2011 3:35	1.875°C
6/8/2011 3:45	1.875°C

Date	Temperature Reading
6/8/2011 3:55	1.875°C
6/8/2011 4:05	1.875°C
6/8/2011 4:15	1.875°C
6/8/2011 4:25	1.875°C
6/8/2011 4:35	1.875°C
6/8/2011 4:45	1.875°C
6/8/2011 4:55	1.875°C
6/8/2011 5:05	1.875°C
6/8/2011 5:15	1.875°C
6/8/2011 5:25	1.875°C
6/8/2011 5:35	1.875°C
6/8/2011 5:45	1.875°C
6/8/2011 5:55	1.875°C
6/8/2011 6:05	1.875°C
6/8/2011 6:15	1.875°C
6/8/2011 6:25	2°C
6/8/2011 6:35	2°C
6/8/2011 6:45	2°C
6/8/2011 6:55	2°C
6/8/2011 7:05	2°C
6/8/2011 7:15	2°C
6/8/2011 7:25	2°C
6/8/2011 7:35	2°C
6/8/2011 7:45	2°C
6/8/2011 7:55	2°C
6/8/2011 8:05	2°C
6/8/2011 8:15	2°C
6/8/2011 8:25	2°C
6/8/2011 8:35	2°C
6/8/2011 8:45	2°C
6/8/2011 8:55	2°C
6/8/2011 9:05	2°C
6/8/2011 9:15	2°C
6/8/2011 9:25	2°C
6/8/2011 9:35	2°C
6/8/2011 9:45	2°C
6/8/2011 9:55	2°C
6/8/2011 10:05	2°C
6/8/2011 10:15	2°C
6/8/2011 10:25	2°C

Table B3contd: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading	Date	Temperature Reading
6/8/2011 10:35	2°C	6/8/2011 17:15	2.25°C
6/8/2011 10:45	2°C	6/8/2011 17:25	2.625°C
6/8/2011 10:55	2°C	6/8/2011 17:35	3°C
6/8/2011 11:05	2°C	6/8/2011 17:45	3.375°C
6/8/2011 11:15	2°C	6/8/2011 17:55	3.625°C
6/8/2011 11:25	2°C	6/8/2011 18:05	3.875°C
6/8/2011 11:35	2°C	6/8/2011 18:15	4°C
6/8/2011 11:45	2°C	6/8/2011 18:25	4°C
6/8/2011 11:55	1.875°C	6/8/2011 18:35	4.125°C
6/8/2011 12:05	1.875°C	6/8/2011 18:45	4.125°C
6/8/2011 12:15	1.875°C	6/8/2011 18:55	4.125°C
6/8/2011 12:25	1.875°C	6/8/2011 19:05	4.125°C
6/8/2011 12:35	1.875°C	6/8/2011 19:15	4.125°C
6/8/2011 12:45	1.875°C	6/8/2011 19:25	4.125°C
6/8/2011 12:55	1.875°C	6/8/2011 19:35	4.125°C
6/8/2011 13:05	1.875°C	6/8/2011 19:45	4.125°C
6/8/2011 13:15	1.875°C	6/8/2011 19:55	4.125°C
6/8/2011 13:25	1.875°C	6/8/2011 20:05	4.125°C
6/8/2011 13:35	1.875°C	6/8/2011 20:15	4.125°C
6/8/2011 13:45	1.875°C	6/8/2011 20:25	4.125°C
6/8/2011 13:55	1.875°C	6/8/2011 20:35	4.125°C
6/8/2011 14:05	1.875°C	6/8/2011 20:45	4.125°C
6/8/2011 14:15	1.875°C	6/8/2011 20:55	4.25°C
6/8/2011 14:25	1.875°C	6/8/2011 21:05	4.25°C
6/8/2011 14:35	1.875°C	6/8/2011 21:15	4.25°C
6/8/2011 14:45	1.75°C	6/8/2011 21:25	4.25°C
6/8/2011 14:55	1.875°C	6/8/2011 21:35	4.25°C
6/8/2011 15:05	1.75°C	6/8/2011 21:45	4.25°C
6/8/2011 15:15	1.75°C	6/8/2011 21:55	4.25°C
6/8/2011 15:25	1.75°C	6/8/2011 22:05	4.25°C
6/8/2011 15:35	1.75°C	6/8/2011 22:15	4.25°C
6/8/2011 15:45	1.75°C	6/8/2011 22:25	4.25°C
6/8/2011 15:55	1.75°C	6/8/2011 22:35	4.25°C
6/8/2011 16:05	1.75°C	6/8/2011 22:45	4.375°C
6/8/2011 16:15	1.75°C	6/8/2011 22:55	4.375°C
6/8/2011 16:25	1.75°C	6/8/2011 23:05	4.375°C
6/8/2011 16:35	1.75°C	6/8/2011 23:15	4.375°C
6/8/2011 16:45	1.75°C	6/8/2011 23:25	4.375°C
6/8/2011 16:55	2.25°C	6/8/2011 23:35	4.375°C
6/8/2011 17:05	2.125°C	6/8/2011 23:45	4.375°C

Table B3$_{contd}$: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
6/8/2011 23:55	4.375°C
7/8/2011 0:05	4.375°C
7/8/2011 0:15	4.375°C
7/8/2011 0:25	4.5°C
7/8/2011 0:35	4.5°C
7/8/2011 0:45	4.5°C
7/8/2011 0:55	4.5°C
7/8/2011 1:05	4.5°C
7/8/2011 1:15	4.5°C
7/8/2011 1:25	4.5°C
7/8/2011 1:35	4.5°C
7/8/2011 1:45	4.5°C
7/8/2011 1:55	4.5°C
7/8/2011 2:05	4.625°C
7/8/2011 2:15	4.625°C
7/8/2011 2:25	4.625°C
7/8/2011 2:35	4.625°C
7/8/2011 2:45	4.625°C
7/8/2011 2:55	4.625°C
7/8/2011 3:05	4.625°C
7/8/2011 3:15	4.625°C
7/8/2011 3:25	4.625°C
7/8/2011 3:35	4.75°C
7/8/2011 3:45	4.75°C
7/8/2011 3:55	4.75°C
7/8/2011 4:05	4.75°C
7/8/2011 4:15	4.75°C
7/8/2011 4:25	4.75°C
7/8/2011 4:35	4.75°C
7/8/2011 4:45	4.75°C
7/8/2011 4:55	4.875°C
7/8/2011 5:05	4.875°C
7/8/2011 5:15	4.875°C
7/8/2011 5:25	4.875°C
7/8/2011 5:35	4.875°C
7/8/2011 5:45	4.875°C
7/8/2011 5:55	4.875°C
7/8/2011 6:05	4.875°C
7/8/2011 6:15	4.875°C
7/8/2011 6:25	5°C

Date	Temperature Reading
7/8/2011 6:35	5°C
7/8/2011 6:45	5°C
7/8/2011 6:55	5°C
7/8/2011 7:05	5°C
7/8/2011 7:15	5°C
7/8/2011 7:25	5°C
7/8/2011 7:35	5°C
7/8/2011 7:45	5°C
7/8/2011 7:55	5.125°C
7/8/2011 8:05	5.125°C
7/8/2011 8:15	5.125°C
7/8/2011 8:25	5.125°C
7/8/2011 8:35	5.125°C
7/8/2011 8:45	5.125°C
7/8/2011 8:55	5.125°C
7/8/2011 9:05	5.125°C
7/8/2011 9:15	5.125°C
7/8/2011 9:25	5.125°C
7/8/2011 9:35	5.25°C
7/8/2011 9:45	5.25°C
7/8/2011 9:55	5.25°C
7/8/2011 10:05	5.25°C
7/8/2011 10:15	5.25°C
7/8/2011 10:25	5.25°C
7/8/2011 10:35	5.25°C
7/8/2011 10:45	5.25°C
7/8/2011 10:55	5.375°C
7/8/2011 11:05	5.375°C
7/8/2011 11:15	5.375°C
7/8/2011 11:25	5.375°C
7/8/2011 11:35	5.375°C
7/8/2011 11:45	5.375°C
7/8/2011 11:55	5.375°C
7/8/2011 12:05	5.375°C
7/8/2011 12:15	5.5°C
7/8/2011 12:25	5.5°C
7/8/2011 12:35	5.5°C
7/8/2011 12:45	5.5°C
7/8/2011 12:55	5.5°C
7/8/2011 13:05	5.5°C

Table B3$_{contd}$: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
7/8/2011 13:15	5.5°C
7/8/2011 13:25	5.5°C
7/8/2011 13:35	5.5°C
7/8/2011 13:45	5.5°C
7/8/2011 13:55	5.625°C
7/8/2011 14:05	5.625°C
7/8/2011 14:15	5.625°C
7/8/2011 14:25	5.625°C
7/8/2011 14:35	5.625°C
7/8/2011 14:45	5.625°C
7/8/2011 14:55	5.625°C
7/8/2011 15:05	5.625°C
7/8/2011 15:15	5.75°C
7/8/2011 15:25	5.75°C
7/8/2011 15:35	5.75°C
7/8/2011 15:45	5.75°C
7/8/2011 15:55	5.75°C
7/8/2011 16:05	5.75°C
7/8/2011 16:15	5.75°C
7/8/2011 16:25	5.75°C
7/8/2011 16:35	5.875°C
7/8/2011 16:45	5.875°C
7/8/2011 16:55	5.875°C
7/8/2011 17:05	5.875°C
7/8/2011 17:15	5.875°C
7/8/2011 17:25	5.875°C
7/8/2011 17:35	5.875°C
7/8/2011 17:45	5.875°C
7/8/2011 17:55	6°C
7/8/2011 18:05	6°C
7/8/2011 18:15	6°C
7/8/2011 18:25	6°C
7/8/2011 18:35	6°C
7/8/2011 18:45	6°C
7/8/2011 18:55	6°C
7/8/2011 19:05	6°C
7/8/2011 19:15	6.125°C
7/8/2011 19:25	6.125°C
7/8/2011 19:35	6.125°C
7/8/2011 19:45	6.125°C

Date	Temperature Reading
7/8/2011 19:55	6.125°C
7/8/2011 20:05	6.125°C
7/8/2011 20:15	6.125°C
7/8/2011 20:25	6.125°C
7/8/2011 20:35	6.125°C
7/8/2011 20:45	6.25°C
7/8/2011 20:55	6.25°C
7/8/2011 21:05	6.25°C
7/8/2011 21:15	6.25°C
7/8/2011 21:25	6.25°C
7/8/2011 21:35	6.25°C
7/8/2011 21:45	6.25°C
7/8/2011 21:55	6.25°C
7/8/2011 22:05	6.375°C
7/8/2011 22:15	6.375°C
7/8/2011 22:25	6.375°C
7/8/2011 22:35	6.375°C
7/8/2011 22:45	6.375°C
7/8/2011 22:55	6.375°C
7/8/2011 23:05	6.375°C
7/8/2011 23:15	6.375°C
7/8/2011 23:25	6.375°C
7/8/2011 23:35	6.5°C
7/8/2011 23:45	6.5°C
7/8/2011 23:55	6.5°C
8/8/2011 0:05	6.5°C
8/8/2011 0:15	6.5°C
8/8/2011 0:25	6.5°C
8/8/2011 0:35	6.5°C
8/8/2011 0:45	6.5°C
8/8/2011 0:55	6.5°C
8/8/2011 1:05	6.625°C
8/8/2011 1:15	6.625°C
8/8/2011 1:25	6.625°C
8/8/2011 1:35	6.625°C
8/8/2011 1:45	6.625°C
8/8/2011 1:55	6.625°C
8/8/2011 2:05	6.625°C
8/8/2011 2:15	6.625°C
8/8/2011 2:25	6.625°C

Table B3contd: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
8/8/2011 2:35	6.75°C
8/8/2011 2:45	6.75°C
8/8/2011 2:55	6.75°C
8/8/2011 3:05	6.75°C
8/8/2011 3:15	6.75°C
8/8/2011 3:25	6.75°C
8/8/2011 3:35	6.75°C
8/8/2011 3:45	6.75°C
8/8/2011 3:55	6.75°C
8/8/2011 4:05	6.75°C
8/8/2011 4:15	6.875°C
8/8/2011 4:25	6.875°C
8/8/2011 4:35	6.875°C
8/8/2011 4:45	6.875°C
8/8/2011 4:55	6.875°C
8/8/2011 5:05	6.875°C
8/8/2011 5:15	6.875°C
8/8/2011 5:25	6.875°C
8/8/2011 5:35	6.875°C
8/8/2011 5:45	6.875°C
8/8/2011 5:55	6.875°C
8/8/2011 6:05	7°C
8/8/2011 6:15	7°C
8/8/2011 6:25	7°C
8/8/2011 6:35	7°C
8/8/2011 6:45	7°C
8/8/2011 6:55	7°C
8/8/2011 7:05	7°C
8/8/2011 7:15	7°C
8/8/2011 7:25	7°C
8/8/2011 7:35	7°C
8/8/2011 7:45	7.125°C
8/8/2011 7:55	7.125°C
8/8/2011 8:05	7.125°C
8/8/2011 8:15	7.125°C
8/8/2011 8:25	7.125°C
8/8/2011 8:35	7.125°C
8/8/2011 8:45	7.125°C
8/8/2011 8:55	7.125°C
8/8/2011 9:05	7.125°C

Date	Temperature Reading
8/8/2011 9:15	7.25°C
8/8/2011 9:25	7.25°C
8/8/2011 9:35	7.25°C
8/8/2011 9:45	7.25°C
8/8/2011 9:55	7.25°C
8/8/2011 10:05	7.25°C
8/8/2011 10:15	7.25°C
8/8/2011 10:25	7.25°C
8/8/2011 10:35	7.25°C
8/8/2011 10:45	7.25°C
8/8/2011 10:55	7.375°C
8/8/2011 11:05	7.375°C
8/8/2011 11:15	7.375°C
8/8/2011 11:25	7.375°C
8/8/2011 11:35	7.375°C
8/8/2011 11:45	7.375°C
8/8/2011 11:55	7.375°C
8/8/2011 12:05	7.375°C
8/8/2011 12:15	7.375°C
8/8/2011 12:25	7.375°C
8/8/2011 12:35	7.375°C
8/8/2011 12:45	7.5°C
8/8/2011 12:55	7.5°C
8/8/2011 13:05	7.5°C
8/8/2011 13:15	7.5°C
8/8/2011 13:25	7.5°C
8/8/2011 13:35	7.5°C
8/8/2011 13:45	7.5°C
8/8/2011 13:55	7.5°C
8/8/2011 14:05	7.625°C
8/8/2011 14:15	7.625°C
8/8/2011 14:25	7.625°C
8/8/2011 14:35	7.625°C
8/8/2011 14:45	7.75°C
8/8/2011 14:55	7.75°C
8/8/2011 15:05	8.75°C
8/8/2011 15:15	10.25°C
8/8/2011 15:25	10.875°C
8/8/2011 15:35	11.375°C
8/8/2011 15:45	11.75°C

Table B3$_{contd}$: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
8/8/2011 15:55	12°C
8/8/2011 16:05	12.125°C
8/8/2011 16:15	12.25°C
8/8/2011 16:25	12.375°C
8/8/2011 16:35	12.5°C
8/8/2011 16:45	12.75°C
8/8/2011 16:55	13°C
8/8/2011 17:05	13.125°C
8/8/2011 17:15	12.625°C
8/8/2011 17:25	12.5°C
8/8/2011 17:35	12.375°C
8/8/2011 17:45	12.375°C
8/8/2011 17:55	12.375°C
8/8/2011 18:05	12.5°C
8/8/2011 18:15	12.5°C
8/8/2011 18:25	12.625°C
8/8/2011 18:35	12.625°C
8/8/2011 18:45	12.75°C
8/8/2011 18:55	12.75°C
8/8/2011 19:05	12.875°C
8/8/2011 19:15	12.875°C
8/8/2011 19:25	13°C
8/8/2011 19:35	13°C
8/8/2011 19:45	13.125°C
8/8/2011 19:55	13.125°C
8/8/2011 20:05	13.25°C
8/8/2011 20:15	13.25°C
8/8/2011 20:25	13.375°C
8/8/2011 20:35	13.375°C
8/8/2011 20:45	13.5°C
8/8/2011 20:55	13.625°C
8/8/2011 21:05	13.625°C
8/8/2011 21:15	13.75°C
8/8/2011 21:25	13.75°C
8/8/2011 21:35	13.875°C
8/8/2011 21:45	13.875°C
8/8/2011 21:55	14°C
8/8/2011 22:05	14°C
8/8/2011 22:15	14.125°C
8/8/2011 22:25	14.25°C
8/8/2011 22:35	14.25°C
8/8/2011 22:45	14.375°C
8/8/2011 22:55	14.375°C
8/8/2011 23:05	14.5°C
8/8/2011 23:15	14.5°C
8/8/2011 23:25	14.625°C
8/8/2011 23:35	14.625°C
8/8/2011 23:45	14.75°C
8/8/2011 23:55	14.75°C
9/8/2011 0:05	14.875°C
9/8/2011 0:15	15°C
9/8/2011 0:25	15°C
9/8/2011 0:35	15.125°C
9/8/2011 0:45	15.125°C
9/8/2011 0:55	15.25°C
9/8/2011 1:05	15.25°C
9/8/2011 1:15	15.375°C
9/8/2011 1:25	15.375°C
9/8/2011 1:35	15.5°C
9/8/2011 1:45	15.5°C
9/8/2011 1:55	15.625°C
9/8/2011 2:05	15.625°C
9/8/2011 2:15	15.75°C
9/8/2011 2:25	15.75°C
9/8/2011 2:35	15.875°C
9/8/2011 2:45	15.875°C
9/8/2011 2:55	16°C
9/8/2011 3:05	16°C
9/8/2011 3:15	16.125°C
9/8/2011 3:25	16.125°C
9/8/2011 3:35	16.25°C
9/8/2011 3:45	16.25°C
9/8/2011 3:55	16.375°C
9/8/2011 4:05	16.375°C
9/8/2011 4:15	16.5°C
9/8/2011 4:25	16.5°C
9/8/2011 4:35	16.625°C
9/8/2011 4:45	16.625°C
9/8/2011 4:55	16.75°C
9/8/2011 5:05	16.75°C

Table B3contd: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
9/8/2011 5:15	16.75°C
9/8/2011 5:25	16.875°C
9/8/2011 5:35	16.875°C
9/8/2011 5:45	17°C
9/8/2011 5:55	17°C
9/8/2011 6:05	17.125°C
9/8/2011 6:15	17.125°C
9/8/2011 6:25	17.25°C
9/8/2011 6:35	17.25°C
9/8/2011 6:45	17.25°C
9/8/2011 6:55	17.375°C
9/8/2011 7:05	17.375°C
9/8/2011 7:15	17.5°C
9/8/2011 7:25	17.5°C
9/8/2011 7:35	17.5°C
9/8/2011 7:45	17.625°C
9/8/2011 7:55	17.625°C
9/8/2011 8:05	17.75°C
9/8/2011 8:15	17.75°C
9/8/2011 8:25	18.375°C
9/8/2011 8:35	18.75°C
9/8/2011 8:45	18.875°C
9/8/2011 8:55	19°C
9/8/2011 9:05	19.125°C
9/8/2011 9:15	19.25°C
9/8/2011 9:25	19.375°C
9/8/2011 9:35	19.625°C
9/8/2011 9:45	19.75°C
9/8/2011 9:55	19.875°C
9/8/2011 10:05	20°C
9/8/2011 10:15	20.125°C
9/8/2011 10:25	20.25°C
9/8/2011 10:35	20.375°C
9/8/2011 10:45	20.5°C
9/8/2011 10:55	20.5°C
9/8/2011 11:05	20.625°C
9/8/2011 11:15	20.75°C
9/8/2011 11:25	20.875°C
9/8/2011 11:35	21°C
9/8/2011 11:45	21°C
9/8/2011 11:55	21.125°C
9/8/2011 12:05	21.25°C
9/8/2011 12:15	21.375°C
9/8/2011 12:25	21.375°C
9/8/2011 12:35	21.5°C
9/8/2011 12:45	21.5°C
9/8/2011 12:55	21.625°C
9/8/2011 13:05	21.75°C
9/8/2011 13:15	21.75°C
9/8/2011 13:25	21.875°C
9/8/2011 13:35	21.875°C
9/8/2011 13:45	22°C
9/8/2011 13:55	22°C
9/8/2011 14:05	22.125°C
9/8/2011 14:15	22.125°C
9/8/2011 14:25	22.25°C
9/8/2011 14:35	22.25°C
9/8/2011 14:45	22.375°C
9/8/2011 14:55	22.375°C
9/8/2011 15:05	22.5°C
9/8/2011 15:15	22.5°C
9/8/2011 15:25	22.625°C
9/8/2011 15:35	22.625°C
9/8/2011 15:45	22.75°C
9/8/2011 15:55	22.75°C
9/8/2011 16:05	22.75°C
9/8/2011 16:15	22.875°C
9/8/2011 16:25	22.875°C
9/8/2011 16:35	22.875°C
9/8/2011 16:45	22.875°C
9/8/2011 16:55	23°C
9/8/2011 17:05	23°C
9/8/2011 17:15	23°C
9/8/2011 17:25	23°C
9/8/2011 17:35	23.125°C
9/8/2011 17:45	23.125°C
9/8/2011 17:55	23.125°C
9/8/2011 18:05	23.125°C
9/8/2011 18:15	23.25°C
9/8/2011 18:25	23.25°C

Table B3$_{contd}$: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading	Date	Temperature Reading
9/8/2011 18:35	23.25°C	10/8/2011 1:15	23.875°C
9/8/2011 18:45	23.25°C	10/8/2011 1:25	23.875°C
9/8/2011 18:55	23.375°C	10/8/2011 1:35	23.875°C
9/8/2011 19:05	23.375°C	10/8/2011 1:45	23.875°C
9/8/2011 19:15	23.375°C	10/8/2011 1:55	23.875°C
9/8/2011 19:25	23.375°C	10/8/2011 2:05	23.875°C
9/8/2011 19:35	23.375°C	10/8/2011 2:15	23.875°C
9/8/2011 19:45	23.375°C	10/8/2011 2:25	23.875°C
9/8/2011 19:55	23.5°C	10/8/2011 2:35	23.875°C
9/8/2011 20:05	23.5°C	10/8/2011 2:45	23.875°C
9/8/2011 20:15	23.5°C	10/8/2011 2:55	23.875°C
9/8/2011 20:25	23.5°C	10/8/2011 3:05	24°C
9/8/2011 20:35	23.5°C	10/8/2011 3:15	24°C
9/8/2011 20:45	23.5°C	10/8/2011 3:25	24°C
9/8/2011 20:55	23.625°C	10/8/2011 3:35	24°C
9/8/2011 21:05	23.625°C	10/8/2011 3:45	24°C
9/8/2011 21:15	23.625°C	10/8/2011 3:55	24°C
9/8/2011 21:25	23.625°C	10/8/2011 4:05	24°C
9/8/2011 21:35	23.625°C	10/8/2011 4:15	24°C
9/8/2011 21:45	23.625°C	10/8/2011 4:25	24°C
9/8/2011 21:55	23.625°C	10/8/2011 4:35	24°C
9/8/2011 22:05	23.625°C	10/8/2011 4:45	24°C
9/8/2011 22:15	23.625°C	10/8/2011 4:55	24°C
9/8/2011 22:25	23.625°C	10/8/2011 5:05	24°C
9/8/2011 22:35	23.75°C	10/8/2011 5:15	24°C
9/8/2011 22:45	23.75°C	10/8/2011 5:25	24°C
9/8/2011 22:55	23.75°C	10/8/2011 5:35	24°C
9/8/2011 23:05	23.75°C	10/8/2011 5:45	24°C
9/8/2011 23:15	23.75°C	10/8/2011 5:55	24°C
9/8/2011 23:25	23.75°C	10/8/2011 6:05	24°C
9/8/2011 23:35	23.75°C	10/8/2011 6:15	24°C
9/8/2011 23:45	23.75°C	10/8/2011 6:25	24°C
9/8/2011 23:55	23.75°C	10/8/2011 6:35	24°C
10/8/2011 0:05	23.75°C	10/8/2011 6:45	24°C
10/8/2011 0:15	23.875°C	10/8/2011 6:55	24°C
10/8/2011 0:25	23.875°C	10/8/2011 7:05	24°C
10/8/2011 0:35	23.875°C	10/8/2011 7:15	24°C
10/8/2011 0:45	23.875°C	10/8/2011 7:25	24°C
10/8/2011 0:55	23.875°C	10/8/2011 7:35	24°C
10/8/2011 1:05	23.875°C	10/8/2011 7:45	24°C

Table B3$_{contd}$: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
10/8/2011 7:55	24°C
10/8/2011 8:05	24°C
10/8/2011 8:15	24°C
10/8/2011 8:25	24°C
10/8/2011 8:35	24°C
10/8/2011 8:45	24°C
10/8/2011 8:55	24°C
10/8/2011 9:05	24°C
10/8/2011 9:15	24°C
10/8/2011 9:25	24°C
10/8/2011 9:35	24°C
10/8/2011 9:45	24°C
10/8/2011 9:55	24°C
10/8/2011 10:05	24°C
10/8/2011 10:15	24°C
10/8/2011 10:25	24°C
10/8/2011 10:35	24°C
10/8/2011 10:45	24°C
10/8/2011 10:55	24°C
10/8/2011 11:05	24°C
10/8/2011 11:15	24°C
10/8/2011 11:25	24°C
10/8/2011 11:35	24°C
10/8/2011 11:45	24°C
10/8/2011 11:55	24°C
10/8/2011 12:05	24°C
10/8/2011 12:15	24°C
10/8/2011 12:25	24°C
10/8/2011 12:35	24°C
10/8/2011 12:45	24°C
10/8/2011 12:55	24°C
10/8/2011 13:05	24°C
10/8/2011 13:15	24°C
10/8/2011 13:25	24°C
10/8/2011 13:35	24°C
10/8/2011 13:45	24°C
10/8/2011 13:55	24°C
10/8/2011 14:05	24°C
10/8/2011 14:15	24°C
10/8/2011 14:25	24.125°C

Date	Temperature Reading
10/8/2011 14:35	24.125°C
10/8/2011 14:45	24.125°C
10/8/2011 14:55	24.125°C
10/8/2011 15:05	24.125°C
10/8/2011 15:15	24.125°C
10/8/2011 15:25	24.125°C
10/8/2011 15:35	24.125°C
10/8/2011 15:45	24.125°C
10/8/2011 15:55	24.125°C
10/8/2011 16:05	24.125°C
10/8/2011 16:15	24.125°C
10/8/2011 16:25	24.125°C
10/8/2011 16:35	24.125°C
10/8/2011 16:45	24.125°C
10/8/2011 16:55	24.125°C
10/8/2011 17:05	24.125°C
10/8/2011 17:15	24.125°C
10/8/2011 17:25	24.125°C
10/8/2011 17:35	24.25°C
10/8/2011 17:45	24.25°C
10/8/2011 17:55	24.25°C
10/8/2011 18:05	24.25°C
10/8/2011 18:15	24.25°C
10/8/2011 18:25	24.25°C
10/8/2011 18:35	24.25°C
10/8/2011 18:45	24.25°C
10/8/2011 18:55	24.25°C
10/8/2011 19:05	24.25°C
10/8/2011 19:15	24.25°C
10/8/2011 19:25	24.25°C
10/8/2011 19:35	24.25°C
10/8/2011 19:45	24.25°C
10/8/2011 19:55	24.25°C
10/8/2011 20:05	24.25°C
10/8/2011 20:15	24.25°C
10/8/2011 20:25	24.25°C
10/8/2011 20:35	24.25°C
10/8/2011 20:45	24.25°C
10/8/2011 20:55	24.375°C
10/8/2011 21:05	24.25°C

Table B3$_{contd}$: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading	Date	Temperature Reading
10/8/2011 21:15	24.375°C	11/8/2011 3:55	24.375°C
10/8/2011 21:25	24.375°C	11/8/2011 4:05	24.375°C
10/8/2011 21:35	24.375°C	11/8/2011 4:15	24.375°C
10/8/2011 21:45	24.375°C	11/8/2011 4:25	24.375°C
10/8/2011 21:55	24.375°C	11/8/2011 4:35	24.375°C
10/8/2011 22:05	24.375°C	11/8/2011 4:45	24.375°C
10/8/2011 22:15	24.375°C	11/8/2011 4:55	24.375°C
10/8/2011 22:25	24.375°C	11/8/2011 5:05	24.375°C
10/8/2011 22:35	24.375°C	11/8/2011 5:15	24.375°C
10/8/2011 22:45	24.375°C	11/8/2011 5:25	24.375°C
10/8/2011 22:55	24.375°C	11/8/2011 5:35	24.375°C
10/8/2011 23:05	24.375°C	11/8/2011 5:45	24.375°C
10/8/2011 23:15	24.375°C	11/8/2011 5:55	24.375°C
10/8/2011 23:25	24.375°C	11/8/2011 6:05	24.375°C
10/8/2011 23:35	24.375°C	11/8/2011 6:15	24.375°C
10/8/2011 23:45	24.375°C	11/8/2011 6:25	24.375°C
10/8/2011 23:55	24.375°C	11/8/2011 6:35	24.375°C
11/8/2011 0:05	24.375°C	11/8/2011 6:45	24.375°C
11/8/2011 0:15	24.375°C	11/8/2011 6:55	24.375°C
11/8/2011 0:25	24.375°C	11/8/2011 7:05	24.375°C
11/8/2011 0:35	24.375°C	11/8/2011 7:15	24.375°C
11/8/2011 0:45	24.375°C	11/8/2011 7:25	24.375°C
11/8/2011 0:55	24.375°C	11/8/2011 7:35	24.375°C
11/8/2011 1:05	24.375°C	11/8/2011 7:45	24.375°C
11/8/2011 1:15	24.375°C	11/8/2011 7:55	24.375°C
11/8/2011 1:25	24.375°C	11/8/2011 8:05	24.375°C
11/8/2011 1:35	24.375°C	11/8/2011 8:15	24.375°C
11/8/2011 1:45	24.375°C	11/8/2011 8:25	24.375°C
11/8/2011 1:55	24.375°C	11/8/2011 8:35	24.375°C
11/8/2011 2:05	24.375°C	11/8/2011 8:45	24.375°C
11/8/2011 2:15	24.375°C	11/8/2011 8:55	24.375°C
11/8/2011 2:25	24.375°C	11/8/2011 9:05	24.375°C
11/8/2011 2:35	24.375°C	11/8/2011 9:15	24.375°C
11/8/2011 2:45	24.375°C	11/8/2011 9:25	24.375°C
11/8/2011 2:55	24.375°C	11/8/2011 9:35	24.375°C
11/8/2011 3:05	24.375°C	11/8/2011 9:45	24.375°C
11/8/2011 3:15	24.375°C	11/8/2011 9:55	24.375°C
11/8/2011 3:25	24.375°C	11/8/2011 10:05	24.375°C
11/8/2011 3:35	24.375°C	11/8/2011 10:15	24.375°C
11/8/2011 3:45	24.375°C	11/8/2011 10:25	24.375°C

Table B3$_{contd}$: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
11/8/2011 10:35	24.375°C
11/8/2011 10:45	24.375°C
11/8/2011 10:55	24.375°C
11/8/2011 11:05	24.375°C
11/8/2011 11:15	24.375°C
11/8/2011 11:25	24.375°C
11/8/2011 11:35	24.375°C
11/8/2011 11:45	24.375°C
11/8/2011 11:55	24.375°C
11/8/2011 12:05	24.375°C
11/8/2011 12:15	24.375°C
11/8/2011 12:25	24.375°C
11/8/2011 12:35	24.375°C
11/8/2011 12:45	24.375°C
11/8/2011 12:55	24.375°C
11/8/2011 13:05	24.375°C
11/8/2011 13:15	24.5°C
11/8/2011 13:25	24.5°C
11/8/2011 13:35	24.5°C
11/8/2011 13:45	24.5°C
11/8/2011 13:55	24.5°C
11/8/2011 14:05	24.5°C
11/8/2011 14:15	24.5°C
11/8/2011 14:25	24.5°C
11/8/2011 14:35	24.5°C
11/8/2011 14:45	24.5°C
11/8/2011 14:55	24.5°C
11/8/2011 15:05	24.5°C
11/8/2011 15:15	24.5°C
11/8/2011 15:25	24.5°C
11/8/2011 15:35	24.625°C
11/8/2011 15:45	24.625°C
11/8/2011 15:55	24.625°C
11/8/2011 16:05	24.625°C
11/8/2011 16:15	24.625°C
11/8/2011 16:25	24.625°C
11/8/2011 16:35	24.625°C
11/8/2011 16:45	24.625°C
11/8/2011 16:55	24.625°C
11/8/2011 17:05	24.625°C

Date	Temperature Reading
11/8/2011 17:15	24.625°C
11/8/2011 17:25	24.625°C
11/8/2011 17:35	24.625°C
11/8/2011 17:45	24.625°C
11/8/2011 17:55	24.75°C
11/8/2011 18:05	24.75°C
11/8/2011 18:15	24.75°C
11/8/2011 18:25	24.75°C
11/8/2011 18:35	24.75°C
11/8/2011 18:45	24.75°C
11/8/2011 18:55	24.75°C
11/8/2011 19:05	24.75°C
11/8/2011 19:15	24.75°C
11/8/2011 19:25	24.75°C
11/8/2011 19:35	24.75°C
11/8/2011 19:45	24.75°C
11/8/2011 19:55	24.75°C
11/8/2011 20:05	24.75°C
11/8/2011 20:15	24.75°C
11/8/2011 20:25	24.75°C
11/8/2011 20:35	24.75°C
11/8/2011 20:45	24.75°C
11/8/2011 20:55	24.75°C
11/8/2011 21:05	24.75°C
11/8/2011 21:15	24.875°C
11/8/2011 21:25	24.875°C
11/8/2011 21:35	24.875°C
11/8/2011 21:45	24.875°C
11/8/2011 21:55	24.875°C
11/8/2011 22:05	24.875°C
11/8/2011 22:15	24.875°C
11/8/2011 22:25	24.875°C
11/8/2011 22:35	24.875°C
11/8/2011 22:45	24.875°C
11/8/2011 22:55	24.875°C
11/8/2011 23:05	24.875°C
11/8/2011 23:15	24.875°C
11/8/2011 23:25	24.875°C
11/8/2011 23:35	24.875°C
11/8/2011 23:45	24.875°C

Table B3$_{contd}$: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
11/8/2011 23:55	25°C
12/8/2011 0:05	25°C
12/8/2011 0:15	25°C
12/8/2011 0:25	25°C
12/8/2011 0:35	25°C
12/8/2011 0:45	25°C
12/8/2011 0:55	25°C
12/8/2011 1:05	25°C
12/8/2011 1:15	25°C
12/8/2011 1:25	25°C
12/8/2011 1:35	25°C
12/8/2011 1:45	25°C
12/8/2011 1:55	25°C
12/8/2011 2:05	25°C
12/8/2011 2:15	25°C
12/8/2011 2:25	25°C
12/8/2011 2:35	24.875°C
12/8/2011 2:45	24.875°C
12/8/2011 2:55	24.875°C
12/8/2011 3:05	24.875°C
12/8/2011 3:15	24.875°C
12/8/2011 3:25	24.875°C
12/8/2011 3:35	24.875°C
12/8/2011 3:45	24.875°C
12/8/2011 3:55	24.875°C
12/8/2011 4:05	24.875°C
12/8/2011 4:15	24.875°C
12/8/2011 4:25	24.875°C
12/8/2011 4:35	24.875°C
12/8/2011 4:45	24.75°C
12/8/2011 4:55	24.75°C
12/8/2011 5:05	24.75°C
12/8/2011 5:15	24.75°C
12/8/2011 5:25	24.75°C
12/8/2011 5:35	24.75°C
12/8/2011 5:45	24.75°C
12/8/2011 5:55	24.75°C
12/8/2011 6:05	24.75°C
12/8/2011 6:15	24.75°C
12/8/2011 6:25	24.625°C

Date	Temperature Reading
12/8/2011 6:35	24.625°C
12/8/2011 6:45	24.625°C
12/8/2011 6:55	24.625°C
12/8/2011 7:05	24.625°C
12/8/2011 7:15	24.625°C
12/8/2011 7:25	24.625°C
12/8/2011 7:35	24.625°C
12/8/2011 7:45	24.625°C
12/8/2011 7:55	24.5°C
12/8/2011 8:05	24.5°C
12/8/2011 8:15	24.5°C
12/8/2011 8:25	24.5°C
12/8/2011 8:35	24.5°C
12/8/2011 8:45	24.5°C
12/8/2011 8:55	24.5°C
12/8/2011 9:05	24.5°C
12/8/2011 9:15	24.5°C
12/8/2011 9:25	24.625°C
12/8/2011 9:35	24.625°C
12/8/2011 9:45	24.625°C
12/8/2011 9:55	24.625°C
12/8/2011 10:05	24.625°C
12/8/2011 10:15	24.625°C
12/8/2011 10:25	24.625°C
12/8/2011 10:35	24.625°C
12/8/2011 10:45	24.625°C
12/8/2011 10:55	24.625°C
12/8/2011 11:05	24.625°C
12/8/2011 11:15	24.625°C
12/8/2011 11:25	24.625°C
12/8/2011 11:35	24.625°C
12/8/2011 11:45	24.625°C
12/8/2011 11:55	24.625°C
12/8/2011 12:05	24.625°C
12/8/2011 12:15	24.625°C
12/8/2011 12:25	24.625°C
12/8/2011 12:35	24.625°C
12/8/2011 12:45	24.625°C
12/8/2011 12:55	24.625°C
12/8/2011 13:05	24.625°C

Table B3contd: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
12/8/2011 13:15	24.625°C
12/8/2011 13:25	24.75°C
12/8/2011 13:35	24.75°C
12/8/2011 13:45	24.75°C
12/8/2011 13:55	24.75°C
12/8/2011 14:05	24.75°C
12/8/2011 14:15	24.75°C
12/8/2011 14:25	24.75°C
12/8/2011 14:35	24.75°C
12/8/2011 14:45	24.75°C
12/8/2011 14:55	24.75°C
12/8/2011 15:05	24.75°C
12/8/2011 15:15	24.75°C
12/8/2011 15:25	24.75°C
12/8/2011 15:35	24.75°C
12/8/2011 15:45	24.75°C
12/8/2011 15:55	24.875°C
12/8/2011 16:05	24.875°C
12/8/2011 16:15	24.875°C
12/8/2011 16:25	24.875°C
12/8/2011 16:35	24.875°C
12/8/2011 16:45	24.875°C
12/8/2011 16:55	24.875°C
12/8/2011 17:05	24.875°C
12/8/2011 17:15	24.875°C
12/8/2011 17:25	24.875°C
12/8/2011 17:35	24.75°C
12/8/2011 17:45	24.75°C
12/8/2011 17:55	24.75°C
12/8/2011 18:05	24.75°C
12/8/2011 18:15	24.75°C
12/8/2011 18:25	24.75°C
12/8/2011 18:35	24.75°C
12/8/2011 18:45	24.75°C
12/8/2011 18:55	24.75°C
12/8/2011 19:05	24.625°C
12/8/2011 19:15	24.625°C
12/8/2011 19:25	24.625°C
12/8/2011 19:35	24.625°C
12/8/2011 19:45	24.625°C
12/8/2011 19:55	24.625°C
12/8/2011 20:05	24.625°C
12/8/2011 20:15	24.625°C
12/8/2011 20:25	24.625°C
12/8/2011 20:35	24.625°C
12/8/2011 20:45	24.625°C
12/8/2011 20:55	24.625°C
12/8/2011 21:05	24.625°C
12/8/2011 21:15	24.625°C
12/8/2011 21:25	24.625°C
12/8/2011 21:35	24.625°C
12/8/2011 21:45	24.625°C
12/8/2011 21:55	24.5°C
12/8/2011 22:05	24.625°C
12/8/2011 22:15	24.5°C
12/8/2011 22:25	24.5°C
12/8/2011 22:35	24.5°C
12/8/2011 22:45	24.5°C
12/8/2011 22:55	24.5°C
12/8/2011 23:05	24.5°C
12/8/2011 23:15	24.5°C
12/8/2011 23:25	24.5°C
12/8/2011 23:35	24.5°C
12/8/2011 23:45	24.5°C
12/8/2011 23:55	24.5°C
13/08/11 00:05	24.5°C
13/08/11 00:15	24.5°C
13/08/11 00:25	24.5°C
13/08/11 00:35	24.5°C
13/08/11 00:45	24.5°C
13/08/11 00:55	24.5°C
13/08/11 01:05	24.5°C
13/08/11 01:15	24.5°C
13/08/11 01:25	24.5°C
13/08/11 01:35	24.5°C
13/08/11 01:45	24.5°C
13/08/11 01:55	24.5°C
13/08/11 02:05	24.5°C
13/08/11 02:15	24.5°C
13/08/11 02:25	24.5°C

Table B3contd: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
13/08/11 02:35	24.5°C
13/08/11 02:45	24.5°C
13/08/11 02:55	24.5°C
13/08/11 03:05	24.5°C
13/08/11 03:15	24.5°C
13/08/11 03:25	24.5°C
13/08/11 03:35	24.5°C
13/08/11 03:45	24.5°C
13/08/11 03:55	24.5°C
13/08/11 04:05	24.5°C
13/08/11 04:15	24.5°C
13/08/11 04:25	24.5°C
13/08/11 04:35	24.5°C
13/08/11 04:45	24.5°C
13/08/11 04:55	24.5°C
13/08/11 05:05	24.5°C
13/08/11 05:15	24.5°C
13/08/11 05:25	24.5°C
13/08/11 05:35	24.375°C
13/08/11 05:45	24.375°C
13/08/11 05:55	24.375°C
13/08/11 06:05	24.375°C
13/08/11 06:15	24.375°C
13/08/11 06:25	24.375°C
13/08/11 06:35	24.375°C
13/08/11 06:45	24.375°C
13/08/11 06:55	24.375°C
13/08/11 07:05	24.375°C
13/08/11 07:15	24.375°C
13/08/11 07:25	24.375°C
13/08/11 07:35	24.375°C
13/08/11 07:45	24.375°C
13/08/11 07:55	24.375°C
13/08/11 08:05	24.375°C
13/08/11 08:15	24.375°C
13/08/11 08:25	24.375°C
13/08/11 08:35	24.375°C
13/08/11 08:45	24.25°C
13/08/11 08:55	24.375°C
13/08/11 09:05	24.375°C

Date	Temperature Reading
13/08/11 09:15	24.25°C
13/08/11 09:25	24.25°C
13/08/11 09:35	24.25°C
13/08/11 09:45	24.25°C
13/08/11 09:55	24.375°C
13/08/11 10:05	24.375°C
13/08/11 10:15	24.375°C
13/08/11 10:25	24.375°C
13/08/11 10:35	24.25°C
13/08/11 10:45	24.25°C
13/08/11 10:55	24.375°C
13/08/11 11:05	24.25°C
13/08/11 11:15	24.375°C
13/08/11 11:25	24.375°C
13/08/11 11:35	24.375°C
13/08/11 11:45	24.375°C
13/08/11 11:55	24.375°C
13/08/11 12:05	24.375°C
13/08/11 12:15	24.375°C
13/08/11 12:25	24.375°C
13/08/11 12:35	24.375°C
13/08/11 12:45	24.375°C
13/08/11 12:55	24.375°C
13/08/11 13:05	24.375°C
13/08/11 13:15	24.375°C
13/08/11 13:25	24.375°C
13/08/11 13:35	24.375°C
13/08/11 13:45	24.375°C
13/08/11 13:55	24.375°C
13/08/11 14:05	24.375°C
13/08/11 14:15	24.375°C
13/08/11 14:25	24.375°C
13/08/11 14:35	24.375°C
13/08/11 14:45	24.375°C
13/08/11 14:55	24.375°C
13/08/11 15:05	24.375°C
13/08/11 15:15	24.375°C
13/08/11 15:25	24.375°C
13/08/11 15:35	24.375°C
13/08/11 15:45	24.375°C

Table B3contd: Environmental temperature recording along Supply Chain 3

Date	Temperature Reading
13/08/11 15:55	24.375°C
13/08/11 16:05	24.375°C
13/08/11 16:15	24.375°C
13/08/11 16:25	24.375°C
13/08/11 16:35	24.375°C
13/08/11 16:45	24.375°C
13/08/11 16:55	24.375°C
13/08/11 17:05	24.375°C
13/08/11 17:15	24.375°C
13/08/11 17:25	24.375°C
13/08/11 17:35	24.375°C
13/08/11 17:45	24.5°C
13/08/11 17:55	24.5°C
13/08/11 18:05	24.375°C
13/08/11 18:15	24.5°C
13/08/11 18:25	24.5°C
13/08/11 18:35	24.5°C
13/08/11 18:45	24.5°C

Date	Temperature Reading
13/08/11 18:55	24.5°C
13/08/11 19:05	24.5°C
13/08/11 19:15	24.5°C
13/08/11 19:25	24.5°C
13/08/11 19:35	24.5°C
13/08/11 19:45	24.5°C
13/08/11 19:55	24.5°C
13/08/11 20:05	24.5°C
13/08/11 20:15	24.5°C
13/08/11 20:25	24.5°C
13/08/11 20:35	24.5°C
13/08/11 20:45	24.5°C
13/08/11 20:55	24.5°C
13/08/11 21:05	24.5°C
13/08/11 21:15	24.5°C
13/08/11 21:25	24.5°C
13/08/11 21:35	24.5°C
13/08/11 21:45	24.5°C

APPENDIX C: Statistical Analysis

C1: Normality test results for data collected along Supply Chain 1

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Initial flesh firmness (kgf)	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 3 days	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 8 days	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 10 days	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 11 days	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 12 days	60	100.0%	0	.0%	60	100.0%
Initial core temperature (°C)	60	100.0%	0	.0%	60	100.0%
Initial Brix (% SSC)	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 3 days	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 8 days	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 10 days	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 11 days	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 12 days	60	100.0%	0	.0%	60	100.0%

Descriptives

			Statistic	Std. Error
Initial flesh firmness (kgf)	Mean		2.3723	.06223
	95% Confidence Interval for Mean	Lower Bound	2.2477	
		Upper Bound	2.4968	
	5% Trimmed Mean		2.3498	
	Median		2.3020	
	Variance		.232	
	Std. Deviation		.48207	
	Minimum		1.68	
	Maximum		3.63	
	Range		1.95	
	Interquartile Range		.71	
	Skewness		.707	.309
	Kurtosis		-.336	.608
Flesh firmness (kgf) after 3 days	Mean		2.1481	.04353
	95% Confidence Interval for Mean	Lower Bound	2.0610	
		Upper Bound	2.2352	
	5% Trimmed Mean		2.1441	
	Median		2.1659	
	Variance		.114	

	Std. Deviation		.33717	
	Minimum		1.52	
	Maximum		2.93	
	Range		1.41	
	Interquartile Range		.58	
	Skewness		.017	.309
	Kurtosis		-.685	.608
Flesh firmness (kgf) after 8 days	Mean		1.1907	.03899
	95% Confidence Interval for Mean	Lower Bound	1.1127	
		Upper Bound	1.2687	
	5% Trimmed Mean		1.1915	
	Median		1.1907	
	Variance		.091	
	Std. Deviation		.30199	
	Minimum		.54	
	Maximum		1.86	
	Range		1.32	
	Interquartile Range		.45	
	Skewness		.061	.309
	Kurtosis		-.946	.608
Flesh firmness (kgf) after 10 days	Mean		.8962	.02699
	95% Confidence Interval for Mean	Lower Bound	.8422	
		Upper Bound	.9502	
	5% Trimmed Mean		.8984	
	Median		.9299	
	Variance		.044	
	Std. Deviation		.20909	
	Minimum		.45	
	Maximum		1.36	
	Range		.91	
	Interquartile Range		.27	
	Skewness		-.196	.309
	Kurtosis		-.139	.608
Flesh firmness (kgf) after 11 days	Mean		.8044	.02144
	95% Confidence Interval for Mean	Lower Bound	.7615	
		Upper Bound	.8473	
	5% Trimmed Mean		.8005	
	Median		.7711	
	Variance		.028	
	Std. Deviation		.16606	
	Minimum		.45	
	Maximum		1.20	
	Range		.75	
	Interquartile Range		.18	
	Skewness		.512	.309
	Kurtosis		.048	.608
Flesh firmness (kgf) after 12 days	Mean		.6324	.01429
	95% Confidence Interval for Mean	Lower Bound	.6038	
		Upper Bound	.6610	
	5% Trimmed Mean		.6287	
	Median		.6350	
	Variance		.012	
	Std. Deviation		.11072	
	Minimum		.45	
	Maximum		.88	
	Range		.43	

	Interquartile Range		.18	
	Skewness		.379	.309
	Kurtosis		-.605	.608
Initial core temperature (°C)	Mean		2.0483	.05386
	95% Confidence Interval for Mean	Lower Bound	1.9406	
		Upper Bound	2.1561	
	5% Trimmed Mean		2.0537	
	Median		2.1000	
	Variance		.174	
	Std. Deviation		.41721	
	Minimum		1.30	
	Maximum		2.70	
	Range		1.40	
	Interquartile Range		.77	
	Skewness		-.285	.309
	Kurtosis		-1.197	.608
Initial Brix (% SSC)	Mean		10.2917	.09407
	95% Confidence Interval for Mean	Lower Bound	10.1034	
		Upper Bound	10.4799	
	5% Trimmed Mean		10.3093	
	Median		10.3000	
	Variance		.531	
	Std. Deviation		.72866	
	Minimum		8.50	
	Maximum		11.90	
	Range		3.40	
	Interquartile Range		.88	
	Skewness		-.361	.309
	Kurtosis		-.080	.608
Brix (% SSC) after 3 days	Mean		10.6433	.12681
	95% Confidence Interval for Mean	Lower Bound	10.3896	
		Upper Bound	10.8971	
	5% Trimmed Mean		10.6444	
	Median		10.7000	
	Variance		.965	
	Std. Deviation		.98228	
	Minimum		8.90	
	Maximum		12.40	
	Range		3.50	
	Interquartile Range		1.65	
	Skewness		-.047	.309
	Kurtosis		-.972	.608
Brix (% SSC) after 8 days	Mean		11.1533	.11253
	95% Confidence Interval for Mean	Lower Bound	10.9282	
		Upper Bound	11.3785	
	5% Trimmed Mean		11.1556	
	Median		11.1500	
	Variance		.760	
	Std. Deviation		.87168	
	Minimum		9.30	
	Maximum		12.90	
	Range		3.60	
	Interquartile Range		1.38	
	Skewness		-.023	.309
	Kurtosis		-.616	.608
Brix (% SSC) after 10 days	Mean		11.1083	.11343

	95% Confidence Interval for Mean	Lower Bound	10.8814	
		Upper Bound	11.3353	
	5% Trimmed Mean		11.1111	
	Median		11.1500	
	Variance		.772	
	Std. Deviation		.87861	
	Minimum		9.30	
	Maximum		12.80	
	Range		3.50	
	Interquartile Range		1.20	
	Skewness		-.026	.309
	Kurtosis		-.749	.608
Brix (% SSC) after 11 days	Mean		10.8900	.14296
	95% Confidence Interval for Mean	Lower Bound	10.6039	
		Upper Bound	11.1761	
	5% Trimmed Mean		10.9167	
	Median		10.8500	
	Variance		1.226	
	Std. Deviation		1.10740	
	Minimum		8.10	
	Maximum		12.90	
	Range		4.80	
	Interquartile Range		1.90	
	Skewness		-.221	.309
	Kurtosis		-.556	.608
Brix (% SSC) after 12 days	Mean		11.1817	.10855
	95% Confidence Interval for Mean	Lower Bound	10.9645	
		Upper Bound	11.3989	
	5% Trimmed Mean		11.2111	
	Median		11.2000	
	Variance		.707	
	Std. Deviation		.84080	
	Minimum		9.10	
	Maximum		12.70	
	Range		3.60	
	Interquartile Range		1.08	
	Skewness		-.420	.309
	Kurtosis		-.070	.608

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Initial flesh firmness (kgf)	.124	60	.023	.939	60	.005
Flesh firmness (kgf) after 3 days	.087	60	.200*	.978	60	.338
Flesh firmness (kgf) after 8 days	.147	60	.003	.963	60	.066
Flesh firmness (kgf) after 10 days	.114	60	.051	.978	60	.353
Flesh firmness (kgf) after 11 days	.100	60	.200*	.967	60	.102
Flesh firmness (kgf) after 12 days	.093	60	.200*	.963	60	.068
Initial core temperature (°C)	.199	60	.000	.916	60	.001
Initial Brix (% SSC)	.111	60	.063	.975	60	.249
Brix (% SSC) after 3 days	.088	60	.200*	.966	60	.088
Brix (% SSC) after 8 days	.062	60	.200*	.986	60	.725

Brix (% SSC) after 10 days	.072	60	.200*	.980	60	.441
Brix (% SSC) after 11 days	.077	60	.200*	.979	60	.406
Brix (% SSC) after 12 days	.081	60	.200*	.974	60	.230

a. Lilliefors Significance Correction
*. This is a lower bound of the true significance.

C2: Normality test results for data collected along Supply Chain 2

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Initial flesh firmness (kgf)	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 3 days	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 4 days	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 5 days	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 4 (1) days	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 7 days	60	100.0%	0	.0%	60	100.0%
Initial Brix (% SSC)	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 3 days	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 4 days	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 5 days	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 4 (1) days	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 7 days	60	100.0%	0	.0%	60	100.0%

Descriptives				
			Statistic	Std. Error
Initial flesh firmness (kgf)	Mean		2.9585	.06793
	95% Confidence Interval for Mean	Lower Bound	2.8226	
		Upper Bound	3.0945	
	5% Trimmed Mean		2.9404	
	Median		2.8123	
	Variance		.277	
	Std. Deviation		.52619	
	Minimum		2.09	
	Maximum		4.24	
	Range		2.15	
	Interquartile Range		.75	
	Skewness		.626	.309
	Kurtosis		-.486	.608
Flesh firmness (kgf) after 3 days	Mean		2.7008	.06267
	95% Confidence Interval for Mean	Lower Bound	2.5753	
		Upper Bound	2.8262	
	5% Trimmed Mean		2.6955	
	Median		2.6422	
	Variance		.236	
	Std. Deviation		.48544	
	Minimum		1.77	
	Maximum		3.70	
	Range		1.93	
	Interquartile Range		.72	
	Skewness		.235	.309

	Kurtosis		-.735	.608
Flesh firmness (kgf) after 4 days	Mean		2.3783	.04866
	95% Confidence Interval for Mean	Lower Bound	2.2810	
		Upper Bound	2.4757	
	5% Trimmed Mean		2.3620	
	Median		2.2906	
	Variance		.142	
	Std. Deviation		.37693	
	Minimum		1.81	
	Maximum		3.52	
	Range		1.70	
	Interquartile Range		.54	
	Skewness		.642	.309
	Kurtosis		-.037	.608
Flesh firmness (kgf) after 5 days	Mean		2.0982	.02887
	95% Confidence Interval for Mean	Lower Bound	2.0405	
		Upper Bound	2.1560	
	5% Trimmed Mean		2.0987	
	Median		2.0638	
	Variance		.050	
	Std. Deviation		.22360	
	Minimum		1.63	
	Maximum		2.52	
	Range		.88	
	Interquartile Range		.33	
	Skewness		.070	.309
	Kurtosis		-.642	.608
Flesh firmness (kgf) after 4 (1) days	Mean		2.3530	.03741
	95% Confidence Interval for Mean	Lower Bound	2.2781	
		Upper Bound	2.4279	
	5% Trimmed Mean		2.3456	
	Median		2.3813	
	Variance		.084	
	Std. Deviation		.28980	
	Minimum		1.66	
	Maximum		3.11	
	Range		1.45	
	Interquartile Range		.39	
	Skewness		.246	.309
	Kurtosis		.306	.608
Flesh firmness (kgf) after 7 days	Mean		1.0697	.01878
	95% Confidence Interval for Mean	Lower Bound	1.0321	
		Upper Bound	1.1073	
	5% Trimmed Mean		1.0739	
	Median		1.0659	
	Variance		.021	
	Std. Deviation		.14550	
	Minimum		.57	
	Maximum		1.43	
	Range		.86	
	Interquartile Range		.18	
	Skewness		-.616	.309
	Kurtosis		2.062	.608
Initial Brix (% SSC)	Mean		9.7033	.14899
	95% Confidence Interval for Mean	Lower Bound	9.4052	
		Upper Bound	10.0015	

	5% Trimmed Mean		9.6778	
	Median		9.4500	
	Variance		1.332	
	Std. Deviation		1.15406	
	Minimum		7.50	
	Maximum		12.30	
	Range		4.80	
	Interquartile Range		1.55	
	Skewness		.380	.309
	Kurtosis		-.330	.608
Brix (% SSC) after 3 days	Mean		10.3317	.14535
	95% Confidence Interval for Mean	Lower Bound	10.0408	
		Upper Bound	10.6225	
	5% Trimmed Mean		10.3630	
	Median		10.5000	
	Variance		1.268	
	Std. Deviation		1.12589	
	Minimum		7.60	
	Maximum		12.30	
	Range		4.70	
	Interquartile Range		1.78	
	Skewness		-.469	.309
	Kurtosis		-.449	.608
Brix (% SSC) after 4 days	Mean		10.3633	.15680
	95% Confidence Interval for Mean	Lower Bound	10.0496	
		Upper Bound	10.6771	
	5% Trimmed Mean		10.3741	
	Median		10.4500	
	Variance		1.475	
	Std. Deviation		1.21460	
	Minimum		7.90	
	Maximum		12.60	
	Range		4.70	
	Interquartile Range		2.07	
	Skewness		-.131	.309
	Kurtosis		-.963	.608
Brix (% SSC) after 5 days	Mean		10.8400	.09597
	95% Confidence Interval for Mean	Lower Bound	10.6480	
		Upper Bound	11.0320	
	5% Trimmed Mean		10.8426	
	Median		10.8000	
	Variance		.553	
	Std. Deviation		.74338	
	Minimum		9.40	
	Maximum		12.20	
	Range		2.80	
	Interquartile Range		1.10	
	Skewness		.084	.309
	Kurtosis		-.882	.608
Brix (% SSC) after 4 (1) days	Mean		10.1750	.14911
	95% Confidence Interval for Mean	Lower Bound	9.8766	
		Upper Bound	10.4734	
	5% Trimmed Mean		10.1500	
	Median		10.2500	
	Variance		1.334	
	Std. Deviation		1.15504	

	Minimum		8.00	
	Maximum		13.50	
	Range		5.50	
	Interquartile Range		1.72	
	Skewness		.226	.309
	Kurtosis		-.045	.608
Brix (% SSC) after 7 days	Mean		10.2167	.16219
	95% Confidence Interval for Mean	Lower Bound	9.8921	
		Upper Bound	10.5412	
	5% Trimmed Mean		10.1611	
	Median		10.1500	
	Variance		1.578	
	Std. Deviation		1.25633	
	Minimum		8.00	
	Maximum		13.40	
	Range		5.40	
	Interquartile Range		1.88	
	Skewness		.591	.309
	Kurtosis		-.313	.608

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Initial flesh firmness (kgf)	.159	60	.001	.941	60	.006
Flesh firmness (kgf) after 3 days	.131	60	.012	.971	60	.159
Flesh firmness (kgf) after 4 days	.115	60	.046	.949	60	.014
Flesh firmness (kgf) after 5 days	.078	60	.200*	.975	60	.254
Flesh firmness (kgf) after 4 (1) days	.056	60	.200*	.987	60	.785
Flesh firmness (kgf) after 7 days	.111	60	.063	.964	60	.070
Initial Brix (% SSC)	.104	60	.173	.975	60	.247
Brix (% SSC) after 3 days	.095	60	.200*	.969	60	.138
Brix (% SSC) after 4 days	.076	60	.200*	.972	60	.176
Brix (% SSC) after 5 days	.080	60	.200*	.971	60	.172
Brix (% SSC) after 4 (1) days	.071	60	.200*	.982	60	.538
Brix (% SSC) after 7 days	.107	60	.082	.954	60	.025

a. Lilliefors Significance Correction
*. This is a lower bound of the true significance.

C3: Normality test results for data collected along Supply Chain 3

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Initial flesh firmness (kgf)	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 3 days	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 5 days	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 6 days	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 7 days	60	100.0%	0	.0%	60	100.0%
Flesh firmness (kgf) after 12 days	60	100.0%	0	.0%	60	100.0%
Initial Brix (% SSC)	60	100.0%	0	.0%	60	100.0%

Brix (% SSC) after 3 days	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 5 days	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 6 days	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 7 days	60	100.0%	0	.0%	60	100.0%
Brix (% SSC) after 12 days	60	100.0%	0	.0%	60	100.0%

Descriptives

			Statistic	Std. Error
Initial flesh firmness (kgf)	Mean		1.5811	.01987
	95% Confidence Interval for Mean	Lower Bound	1.5414	
		Upper Bound	1.6209	
	5% Trimmed Mean		1.5850	
	Median		1.5876	
	Variance		.024	
	Std. Deviation		.15394	
	Minimum		1.16	
	Maximum		1.91	
	Range		.75	
	Interquartile Range		.20	
	Skewness		-.398	.309
	Kurtosis		.278	.608
Flesh firmness (kgf) after 3 days	Mean		1.4534	.02816
	95% Confidence Interval for Mean	Lower Bound	1.3970	
		Upper Bound	1.5097	
	5% Trimmed Mean		1.4448	
	Median		1.4515	
	Variance		.048	
	Std. Deviation		.21815	
	Minimum		1.04	
	Maximum		2.06	
	Range		1.02	
	Interquartile Range		.31	
	Skewness		.496	.309
	Kurtosis		.391	.608
Flesh firmness (kgf) after 5 days	Mean		1.2723	.02339
	95% Confidence Interval for Mean	Lower Bound	1.2255	
		Upper Bound	1.3191	
	5% Trimmed Mean		1.2713	
	Median		1.2587	
	Variance		.033	
	Std. Deviation		.18118	
	Minimum		.86	
	Maximum		1.66	
	Range		.79	
	Interquartile Range		.27	
	Skewness		.204	.309
	Kurtosis		-.418	.608
Flesh firmness (kgf) after 6 days	Mean		1.2024	.02690
	95% Confidence Interval for Mean	Lower Bound	1.1486	
		Upper Bound	1.2562	
	5% Trimmed Mean		1.2037	
	Median		1.1793	
	Variance		.043	
	Std. Deviation		.20838	
	Minimum		.75	
	Maximum		1.61	
	Range		.86	

	Interquartile Range		.31	
	Skewness		.158	.309
	Kurtosis		-.499	.608
Flesh firmness (kgf) after 7 days	Mean		1.0580	.01601
	95% Confidence Interval for Mean	Lower Bound	1.0260	
		Upper Bound	1.0900	
	5% Trimmed Mean		1.0596	
	Median		1.0773	
	Variance		.015	
	Std. Deviation		.12400	
	Minimum		.79	
	Maximum		1.29	
	Range		.50	
	Interquartile Range		.18	
	Skewness		-.175	.309
	Kurtosis		-.762	.608
Flesh firmness (kgf) after 12 days	Mean		.7904	.02426
	95% Confidence Interval for Mean	Lower Bound	.7418	
		Upper Bound	.8389	
	5% Trimmed Mean		.7896	
	Median		.7824	
	Variance		.035	
	Std. Deviation		.18790	
	Minimum		.45	
	Maximum		1.16	
	Range		.70	
	Interquartile Range		.33	
	Skewness		.068	.309
	Kurtosis		-1.121	.608
Initial Brix (% SSC)	Mean		10.2833	.10470
	95% Confidence Interval for Mean	Lower Bound	10.0738	
		Upper Bound	10.4928	
	5% Trimmed Mean		10.2852	
	Median		10.3500	
	Variance		.658	
	Std. Deviation		.81098	
	Minimum		8.70	
	Maximum		12.00	
	Range		3.30	
	Interquartile Range		.97	
	Skewness		-.354	.309
	Kurtosis		-.394	.608
Brix (% SSC) after 3 days	Mean		10.3700	.08465
	95% Confidence Interval for Mean	Lower Bound	10.2006	
		Upper Bound	10.5394	
	5% Trimmed Mean		10.3630	
	Median		10.5000	
	Variance		.430	
	Std. Deviation		.65569	
	Minimum		8.80	
	Maximum		11.90	
	Range		3.10	
	Interquartile Range		.88	
	Skewness		-.153	.309
	Kurtosis		.078	.608
Brix (% SSC) after 5 days	Mean		10.7733	.04459
	95% Confidence Interval for Mean	Lower Bound	10.6841	
		Upper Bound	10.8626	
	5% Trimmed Mean		10.7667	

	Median		10.7500	
	Variance		.119	
	Std. Deviation		.34536	
	Minimum		10.10	
	Maximum		11.60	
	Range		1.50	
	Interquartile Range		.47	
	Skewness		.455	.309
	Kurtosis		-.205	.608
Brix (% SSC) after 6 days	Mean		10.9983	.05307
	95% Confidence Interval for Mean	Lower Bound	10.8921	
		Upper Bound	11.1045	
	5% Trimmed Mean		10.9963	
	Median		10.9500	
	Variance		.169	
	Std. Deviation		.41107	
	Minimum		10.30	
	Maximum		11.80	
	Range		1.50	
	Interquartile Range		.80	
	Skewness		.067	.309
	Kurtosis		-1.285	.608
Brix (% SSC) after 7 days	Mean		11.2200	.04650
	95% Confidence Interval for Mean	Lower Bound	11.1269	
		Upper Bound	11.3131	
	5% Trimmed Mean		11.2259	
	Median		11.3000	
	Variance		.130	
	Std. Deviation		.36023	
	Minimum		10.50	
	Maximum		11.80	
	Range		1.30	
	Interquartile Range		.60	
	Skewness		-.296	.309
	Kurtosis		-.920	.608
Brix (% SSC) after 12 days	Mean		11.9583	.05794
	95% Confidence Interval for Mean	Lower Bound	11.8424	
		Upper Bound	12.0743	
	5% Trimmed Mean		11.9500	
	Median		11.9000	
	Variance		.201	
	Std. Deviation		.44884	
	Minimum		10.90	
	Maximum		13.00	
	Range		2.10	
	Interquartile Range		.68	
	Skewness		.241	.309
	Kurtosis		-.175	.608

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Initial flesh firmness (kgf)	.084	60	.200*	.986	60	.708
Flesh firmness (kgf) after 3 days	.086	60	.200*	.972	60	.190
Flesh firmness (kgf) after 5 days	.105	60	.096	.979	60	.376
Flesh firmness (kgf) after 6 days	.117	60	.039	.967	60	.105
Flesh firmness (kgf) after 7 days	.102	60	.187	.972	60	.176

Flesh firmness (kgf) after 12 days	.104	60	.167	.963	60	.067
Initial Brix (% SSC)	.097	60	.200*	.961	60	.052
Brix (% SSC) after 3 days	.095	60	.200*	.974	60	.233
Brix (% SSC) after 5 days	.119	60	.033	.966	60	.089
Brix (% SSC) after 6 days	.135	60	.008	.941	60	.006
Brix (% SSC) after 7 days	.121	60	.028	.953	60	.023
Brix (% SSC) after 12 days	.093	60	.200*	.981	60	.483

a. Lilliefors Significance Correction
*. This is a lower bound of the true significance.

C4: Paired T-test results for flesh firmness data collected along Supply Chain 1
C4-1: Paired T-test results for Grower line 1

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	2.0491	20	.21943	.04907
	Flesh firmness (kgf) after 3 days	1.9595	20	.23028	.05149
Pair 2	Flesh firmness (kgf) after 3 days	1.9595	20	.23028	.05149
	Flesh firmness (kgf) after 8 days	.8970	20	.10021	.02241
Pair 3	Flesh firmness (kgf) after 8 days	.8970	20	.10021	.02241
	Flesh firmness (kgf) after 10 days	.6838	20	.14005	.03132
Pair 4	Flesh firmness (kgf) after 10 days	.6838	20	.14005	.03132
	Flesh firmness (kgf) after 11 days	.6668	20	.07299	.01632
Pair 5	Flesh firmness (kgf) after 11 days	.6668	20	.07299	.01632
	Flesh firmness (kgf) after 12 days	.5432	20	.05431	.01214

a. Grower line = 1

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	.422	.064
Pair 2	Flesh firmness (kgf) after 3 days & Flesh firmness (kgf) after 8 days	20	.083	.728
Pair 3	Flesh firmness (kgf) after 8 days & Flesh firmness (kgf) after 10 days	20	-.217	.357
Pair 4	Flesh firmness (kgf) after 10 days & Flesh firmness (kgf) after 11 days	20	-.382	.097
Pair 5	Flesh firmness (kgf) after 11 days & Flesh firmness (kgf) after 12 days	20	-.209	.377

a. Grower line = 1

Paired Samples Test[a]

	Paired Differences				t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			

					Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.08958	.24198	.05411	-.02367	.20283	1.656	19	.114
Pair 2	Flesh firmness (kgf) after 3 days - Flesh firmness (kgf) after 8 days	1.06253	.24341	.05443	.94862	1.17645	19.522	19	.000
Pair 3	Flesh firmness (kgf) after 8 days - Flesh firmness (kgf) after 10 days	.21319	.18909	.04228	.12469	.30169	5.042	19	.000
Pair 4	Flesh firmness (kgf) after 10 days - Flesh firmness (kgf) after 11 days	.01701	.18097	.04047	-.06769	.10171	.420	19	.679
Pair 5	Flesh firmness (kgf) after 11 days - Flesh firmness (kgf) after 12 days	.12360	.09967	.02229	.07696	.17025	5.546	19	.000

a. Grower line = 1

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	2.0491	20	.21943	.04907
	Flesh firmness (kgf) after 3 days	1.9595	20	.23028	.05149
Pair 2	Initial flesh firmness (kgf)	2.0491	20	.21943	.04907
	Flesh firmness (kgf) after 8 days	.8970	20	.10021	.02241
Pair 3	Initial flesh firmness (kgf)	2.0491	20	.21943	.04907
	Flesh firmness (kgf) after 10 days	.6838	20	.14005	.03132
Pair 4	Initial flesh firmness (kgf)	2.0491	20	.21943	.04907
	Flesh firmness (kgf) after 11 days	.6668	20	.07299	.01632
Pair 5	Initial flesh firmness (kgf)	2.0491	20	.21943	.04907
	Flesh firmness (kgf) after 12 days	.5432	20	.05431	.01214

a. Grower line = 1

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	.422	.064
Pair 2	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 8 days	20	.165	.487
Pair 3	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 10 days	20	-.418	.066
Pair 4	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 11 days	20	-.001	.995
Pair 5	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 12 days	20	-.058	.807

a. Grower line = 1

Paired Samples Test[a]

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.08958	.24198	.05411	-.02367	.20283	1.656	19	.114
Pair 2 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 8 days	1.15212	.22567	.05046	1.04650	1.25774	22.832	19	.000
Pair 3 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 10 days	1.36531	.30575	.06837	1.22221	1.50840	19.970	19	.000
Pair 4 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 11 days	1.38232	.23134	.05173	1.27404	1.49059	26.722	19	.000
Pair 5 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 12 days	1.50592	.22910	.05123	1.39870	1.61314	29.396	19	.000

a. Grower line = 1

C4-2: Paired T-test for Grower line 2

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	2.3065	20	.40182	.08985
	Flesh firmness (kgf) after 3 days	2.0071	20	.29912	.06688
Pair 2	Flesh firmness (kgf) after 3 days	2.0071	20	.29912	.06688
	Flesh firmness (kgf) after 8 days	1.2417	20	.21962	.04911
Pair 3	Flesh firmness (kgf) after 8 days	1.2417	20	.21962	.04911
	Flesh firmness (kgf) after 10 days	1.0251	20	.17093	.03822
Pair 4	Flesh firmness (kgf) after 10 days	1.0251	20	.17093	.03822
	Flesh firmness (kgf) after 11 days	.7836	20	.06763	.01512
Pair 5	Flesh firmness (kgf) after 11 days	.7836	20	.06763	.01512
	Flesh firmness (kgf) after 12 days	.6713	20	.11313	.02530

a. Grower line = 2

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	-.584	.007
Pair 2	Flesh firmness (kgf) after 3 days & Flesh firmness (kgf) after 8 days	20	.226	.339
Pair 3	Flesh firmness (kgf) after 8 days & Flesh firmness (kgf) after 10 days	20	.004	.988
Pair 4	Flesh firmness (kgf) after 10 days & Flesh firmness (kgf) after 11 days	20	.217	.357

Pair 5	Flesh firmness (kgf) after 11 days & Flesh firmness (kgf) after 12 days	20	.451	.046

a. Grower line = 2

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.29937	.62560	.13989	.00658	.59216	2.140	19	.046
Pair 2	Flesh firmness (kgf) after 3 days - Flesh firmness (kgf) after 8 days	.76543	.32873	.07351	.61158	.91928	10.413	19	.000
Pair 3	Flesh firmness (kgf) after 8 days - Flesh firmness (kgf) after 10 days	.21659	.27781	.06212	.08657	.34661	3.487	19	.002
Pair 4	Flesh firmness (kgf) after 10 days - Flesh firmness (kgf) after 11 days	.24154	.16960	.03792	.16216	.32091	6.369	19	.000
Pair 5	Flesh firmness (kgf) after 11 days - Flesh firmness (kgf) after 12 days	.11226	.10235	.02289	.06436	.16016	4.905	19	.000

a. Grower line = 2

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	2.3065	20	.40182	.08985
	Flesh firmness (kgf) after 3 days	2.0071	20	.29912	.06688
Pair 2	Initial flesh firmness (kgf)	2.3065	20	.40182	.08985
	Flesh firmness (kgf) after 8 days	1.2417	20	.21962	.04911
Pair 3	Initial flesh firmness (kgf)	2.3065	20	.40182	.08985
	Flesh firmness (kgf) after 10 days	1.0251	20	.17093	.03822
Pair 4	Initial flesh firmness (kgf)	2.3065	20	.40182	.08985
	Flesh firmness (kgf) after 11 days	.7836	20	.06763	.01512
Pair 5	Initial flesh firmness (kgf)	2.3065	20	.40182	.08985
	Flesh firmness (kgf) after 12 days	.6713	20	.11313	.02530

a. Grower line = 2

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	-.584	.007
Pair 2	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 8 days	20	-.135	.569

Pair 3	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 10 days	20	.012	.959
Pair 4	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 11 days	20	-.144	.544
Pair 5	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 12 days	20	.147	.535

a. Grower line = 2

Paired Samples Test[a]

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.29937	.62560	.13989	.00658	.59216	2.140	19	.046
Pair 2 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 8 days	1.06480	.48332	.10807	.83860	1.29100	9.853	19	.000
Pair 3 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 10 days	1.28139	.43473	.09721	1.07793	1.48485	13.182	19	.000
Pair 4 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 11 days	1.52293	.41698	.09324	1.32778	1.71808	16.334	19	.000
Pair 5 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 12 days	1.63519	.40107	.08968	1.44749	1.82290	18.233	19	.000

a. Grower line = 2

C4-3: Paired T-test for Grower line 3

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	2.7612	20	.48814	.10915
	Flesh firmness (kgf) after 3 days	2.4777	20	.19438	.04347
Pair 2	Flesh firmness (kgf) after 3 days	2.4777	20	.19438	.04347
	Flesh firmness (kgf) after 8 days	1.4333	20	.26342	.05890
Pair 3	Flesh firmness (kgf) after 8 days	1.4333	20	.26342	.05890
	Flesh firmness (kgf) after 10 days	.9798	20	.12082	.02702
Pair 4	Flesh firmness (kgf) after 10 days	.9798	20	.12082	.02702
	Flesh firmness (kgf) after 11 days	.9627	20	.17011	.03804
Pair 5	Flesh firmness (kgf) after 11 days	.9627	20	.17011	.03804
	Flesh firmness (kgf) after 12 days	.6827	20	.09842	.02201

a. Grower line = 3

Paired Samples Correlations[a]

	N	Correlation	Sig.

Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	.159	.502
Pair 2	Flesh firmness (kgf) after 3 days & Flesh firmness (kgf) after 8 days	20	.233	.324
Pair 3	Flesh firmness (kgf) after 8 days & Flesh firmness (kgf) after 10 days	20	.052	.827
Pair 4	Flesh firmness (kgf) after 10 days & Flesh firmness (kgf) after 11 days	20	.468	.037
Pair 5	Flesh firmness (kgf) after 11 days & Flesh firmness (kgf) after 12 days	20	-.063	.792

a. Grower line = 3

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.28349	.49582	.11087	.05144	.51554	2.557	19	.019
Pair 2	Flesh firmness (kgf) after 3 days - Flesh firmness (kgf) after 8 days	1.04439	.28871	.06456	.90927	1.17951	16.178	19	.000
Pair 3	Flesh firmness (kgf) after 8 days - Flesh firmness (kgf) after 10 days	.45359	.28403	.06351	.32066	.58652	7.142	19	.000
Pair 4	Flesh firmness (kgf) after 10 days - Flesh firmness (kgf) after 11 days	.01701	.15590	.03486	-.05595	.08997	.488	19	.631
Pair 5	Flesh firmness (kgf) after 11 days - Flesh firmness (kgf) after 12 days	.28009	.20182	.04513	.18564	.37455	6.207	19	.000

a. Grower line = 3

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	2.7612	20	.48814	.10915
	Flesh firmness (kgf) after 3 days	2.4777	20	.19438	.04347
Pair 2	Initial flesh firmness (kgf)	2.7612	20	.48814	.10915
	Flesh firmness (kgf) after 8 days	1.4333	20	.26342	.05890
Pair 3	Initial flesh firmness (kgf)	2.7612	20	.48814	.10915
	Flesh firmness (kgf) after 10 days	.9798	20	.12082	.02702
Pair 4	Initial flesh firmness (kgf)	2.7612	20	.48814	.10915
	Flesh firmness (kgf) after 11 days	.9627	20	.17011	.03804
Pair 5	Initial flesh firmness (kgf)	2.7612	20	.48814	.10915

	Flesh firmness (kgf) after 12 days	.6827	20	.09842	.02201

a. Grower line = 3

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	.159	.502
Pair 2	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 8 days	20	.276	.238
Pair 3	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 10 days	20	-.449	.047
Pair 4	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 11 days	20	-.208	.379
Pair 5	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 12 days	20	.118	.620

a. Grower line = 3

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.28349	.49582	.11087	.05144	.51554	2.557	19	.019
Pair 2	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 8 days	1.32788	.48645	.10877	1.10022	1.55555	12.208	19	.000
Pair 3	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 10 days	1.78147	.55302	.12366	1.52266	2.04029	14.406	19	.000
Pair 4	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 11 days	1.79848	.54931	.12283	1.54140	2.05557	14.642	19	.000
Pair 5	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 12 days	2.07858	.48644	.10877	1.85092	2.30624	19.110	19	.000

a. Grower line = 3

C5: Paired T-test for soluble solids content (Brix) data collected along Supply Chain 1
C5-1: Paired T-test results for Grower line 1

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.6950	20	.62616	.14001
	Brix (% SSC) after 3 days	10.9600	20	1.03334	.23106
Pair 2	Brix (% SSC) after 3 days	10.9600	20	1.03334	.23106
	Brix (% SSC) after 8 days	11.4450	20	.72582	.16230
Pair 3	Brix (% SSC) after 8 days	11.4450	20	.72582	.16230
	Brix (% SSC) after 10 days	11.5150	20	.66275	.14820
Pair 4	Brix (% SSC) after 10 days	11.5150	20	.66275	.14820
	Brix (% SSC) after 11 days	11.8750	20	.57020	.12750

Pair 5	Brix (% SSC) after 11 days	11.8750	20	.57020	.12750
	Brix (% SSC) after 12 days	11.3500	20	.83760	.18729

a. Grower line = 1

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	.088	.711
Pair 2	Brix (% SSC) after 3 days & Brix (% SSC) after 8 days	20	.047	.845
Pair 3	Brix (% SSC) after 8 days & Brix (% SSC) after 10 days	20	-.340	.143
Pair 4	Brix (% SSC) after 10 days & Brix (% SSC) after 11 days	20	.140	.555
Pair 5	Brix (% SSC) after 11 days & Brix (% SSC) after 12 days	20	.183	.439

a. Grower line = 1

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.26500	1.15998	.25938	-.80789	.27789	-1.022	19	.320
Pair 2	Brix (% SSC) after 3 days - Brix (% SSC) after 8 days	-.48500	1.23471	.27609	-1.06286	.09286	-1.757	19	.095
Pair 3	Brix (% SSC) after 8 days - Brix (% SSC) after 10 days	-.07000	1.13699	.25424	-.60213	.46213	-.275	19	.786
Pair 4	Brix (% SSC) after 10 days - Brix (% SSC) after 11 days	-.36000	.81137	.18143	-.73973	.01973	-1.984	19	.062
Pair 5	Brix (% SSC) after 11 days - Brix (% SSC) after 12 days	.52500	.92274	.20633	.09314	.95686	2.544	19	.020

a. Grower line = 1

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.6950	20	.62616	.14001
	Brix (% SSC) after 3 days	10.9600	20	1.03334	.23106
Pair 2	Initial Brix (% SSC)	10.6950	20	.62616	.14001
	Brix (% SSC) after 8 days	11.4450	20	.72582	.16230
Pair 3	Initial Brix (% SSC)	10.6950	20	.62616	.14001
	Brix (% SSC) after 10 days	11.5150	20	.66275	.14820
Pair 4	Initial Brix (% SSC)	10.6950	20	.62616	.14001
	Brix (% SSC) after 11 days	11.8750	20	.57020	.12750
Pair 5	Initial Brix (% SSC)	10.6950	20	.62616	.14001
	Brix (% SSC) after 12 days	11.3500	20	.83760	.18729

a. Grower line = 1

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	.088	.711
Pair 2	Initial Brix (% SSC) & Brix (% SSC) after 8 days	20	-.412	.071
Pair 3	Initial Brix (% SSC) & Brix (% SSC) after 10 days	20	.245	.298
Pair 4	Initial Brix (% SSC) & Brix (% SSC) after 11 days	20	.123	.604
Pair 5	Initial Brix (% SSC) & Brix (% SSC) after 12 days	20	-.166	.484

a. Grower line = 1

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.26500	1.15998	.25938	-.80789	.27789	-1.022	19	.320
Pair 2	Initial Brix (% SSC) - Brix (% SSC) after 8 days	-.75000	1.13717	.25428	-1.28221	-.21779	-2.950	19	.008
Pair 3	Initial Brix (% SSC) - Brix (% SSC) after 10 days	-.82000	.79246	.17720	-1.19088	-.44912	-4.628	19	.000
Pair 4	Initial Brix (% SSC) - Brix (% SSC) after 11 days	-1.18000	.79313	.17735	-1.55120	-.80880	-6.654	19	.000
Pair 5	Initial Brix (% SSC) - Brix (% SSC) after 12 days	-.65500	1.12600	.25178	-1.18198	-.12802	-2.601	19	.018

a. Grower line = 1

C5-1: Paired T-test results for Grower line 2

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.0000	20	.77595	.17351
	Brix (% SSC) after 3 days	10.5850	20	.96260	.21524
Pair 2	Brix (% SSC) after 3 days	10.5850	20	.96260	.21524
	Brix (% SSC) after 8 days	10.7700	20	.65140	.14566
Pair 3	Brix (% SSC) after 8 days	10.7700	20	.65140	.14566
	Brix (% SSC) after 10 days	10.7800	20	.89006	.19902
Pair 4	Brix (% SSC) after 10 days	10.7800	20	.89006	.19902
	Brix (% SSC) after 11 days	9.7850	20	.66434	.14855
Pair 5	Brix (% SSC) after 11 days	9.7850	20	.66434	.14855
	Brix (% SSC) after 12 days	10.7300	20	.77466	.17322

a. Grower line = 2

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	-.051	.832

Pair 2	Brix (% SSC) after 3 days & Brix (% SSC) after 8 days	20	-.098	.681
Pair 3	Brix (% SSC) after 8 days & Brix (% SSC) after 10 days	20	-.339	.144
Pair 4	Brix (% SSC) after 10 days & Brix (% SSC) after 11 days	20	-.137	.565
Pair 5	Brix (% SSC) after 11 days & Brix (% SSC) after 12 days	20	.614	.004

a. Grower line = 2

Paired Samples Test[a]

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.58500	1.26669	.28324	-1.17783	.00783	-2.065	19	.053
Pair 2	Brix (% SSC) after 3 days - Brix (% SSC) after 8 days	-.18500	1.21407	.27148	-.75320	.38320	-.681	19	.504
Pair 3	Brix (% SSC) after 8 days - Brix (% SSC) after 10 days	-.01000	1.26861	.28367	-.60373	.58373	-.035	19	.972
Pair 4	Brix (% SSC) after 10 days - Brix (% SSC) after 11 days	.99500	1.18120	.26412	.44218	1.54782	3.767	19	.001
Pair 5	Brix (% SSC) after 11 days - Brix (% SSC) after 12 days	-.94500	.64029	.14317	-1.24467	-.64533	-6.600	19	.000

a. Grower line = 2

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.0000	20	.77595	.17351
	Brix (% SSC) after 3 days	10.5850	20	.96260	.21524
Pair 2	Initial Brix (% SSC)	10.0000	20	.77595	.17351
	Brix (% SSC) after 8 days	10.7700	20	.65140	.14566
Pair 3	Initial Brix (% SSC)	10.0000	20	.77595	.17351
	Brix (% SSC) after 10 days	10.7800	20	.89006	.19902
Pair 4	Initial Brix (% SSC)	10.0000	20	.77595	.17351
	Brix (% SSC) after 11 days	9.7850	20	.66434	.14855
Pair 5	Initial Brix (% SSC)	10.0000	20	.77595	.17351
	Brix (% SSC) after 12 days	10.7300	20	.77466	.17322

a. Grower line = 2

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	-.051	.832
Pair 2	Initial Brix (% SSC) & Brix (% SSC) after 8 days	20	-.124	.603
Pair 3	Initial Brix (% SSC) & Brix (% SSC) after 10 days	20	.043	.858
Pair 4	Initial Brix (% SSC) & Brix (% SSC) after 11 days	20	.213	.366

Pair 5	Initial Brix (% SSC) & Brix (% SSC) after 12 days	20	.075	.752

a. Grower line = 2

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.58500	1.26669	.28324	-1.17783	.00783	-2.065	19	.053
Pair 2	Initial Brix (% SSC) - Brix (% SSC) after 8 days	-.77000	1.07317	.23997	-1.27226	-.26774	-3.209	19	.005
Pair 3	Initial Brix (% SSC) - Brix (% SSC) after 10 days	-.78000	1.15558	.25840	-1.32083	-.23917	-3.019	19	.007
Pair 4	Initial Brix (% SSC) - Brix (% SSC) after 11 days	.21500	.90744	.20291	-.20969	.63969	1.060	19	.303
Pair 5	Initial Brix (% SSC) - Brix (% SSC) after 12 days	-.73000	1.05436	.23576	-1.22346	-.23654	-3.096	19	.006

a. Grower line = 2

C5-1: Paired T-test results for Grower line 3

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.1800	20	.61695	.13795
	Brix (% SSC) after 3 days	10.3850	20	.90686	.20278
Pair 2	Brix (% SSC) after 3 days	10.3850	20	.90686	.20278
	Brix (% SSC) after 8 days	11.2450	20	1.07482	.24034
Pair 3	Brix (% SSC) after 8 days	11.2450	20	1.07482	.24034
	Brix (% SSC) after 10 days	11.0300	20	.93364	.20877
Pair 4	Brix (% SSC) after 10 days	11.0300	20	.93364	.20877
	Brix (% SSC) after 11 days	11.0100	20	.84847	.18972
Pair 5	Brix (% SSC) after 11 days	11.0100	20	.84847	.18972
	Brix (% SSC) after 12 days	11.4650	20	.75133	.16800

a. Grower line = 3

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	-.133	.576
Pair 2	Brix (% SSC) after 3 days & Brix (% SSC) after 8 days	20	-.044	.855
Pair 3	Brix (% SSC) after 8 days & Brix (% SSC) after 10 days	20	-.092	.701
Pair 4	Brix (% SSC) after 10 days & Brix (% SSC) after 11 days	20	-.124	.603
Pair 5	Brix (% SSC) after 11 days & Brix (% SSC) after 12 days	20	.282	.228

a. Grower line = 3

Paired Samples Test[a]

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.20500	1.16279	.26001	-.74920	.33920	-.788	19	.440
Pair 2 Brix (% SSC) after 3 days - Brix (% SSC) after 8 days	-.86000	1.43615	.32113	-1.53214	-.18786	-2.678	19	.015
Pair 3 Brix (% SSC) after 8 days - Brix (% SSC) after 10 days	.21500	1.48688	.33248	-.48088	.91088	.647	19	.526
Pair 4 Brix (% SSC) after 10 days - Brix (% SSC) after 11 days	.02000	1.33716	.29900	-.60581	.64581	.067	19	.947
Pair 5 Brix (% SSC) after 11 days - Brix (% SSC) after 12 days	-.45500	.96162	.21502	-.90505	-.00495	-2.116	19	.048

a. Grower line = 3

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.1800	20	.61695	.13795
	Brix (% SSC) after 3 days	10.3850	20	.90686	.20278
Pair 2	Initial Brix (% SSC)	10.1800	20	.61695	.13795
	Brix (% SSC) after 8 days	11.2450	20	1.07482	.24034
Pair 3	Initial Brix (% SSC)	10.1800	20	.61695	.13795
	Brix (% SSC) after 10 days	11.0300	20	.93364	.20877
Pair 4	Initial Brix (% SSC)	10.1800	20	.61695	.13795
	Brix (% SSC) after 11 days	11.0100	20	.84847	.18972
Pair 5	Initial Brix (% SSC)	10.1800	20	.61695	.13795
	Brix (% SSC) after 12 days	11.4650	20	.75133	.16800

a. Grower line = 3

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	-.133	.576
Pair 2	Initial Brix (% SSC) & Brix (% SSC) after 8 days	20	-.075	.754
Pair 3	Initial Brix (% SSC) & Brix (% SSC) after 10 days	20	-.094	.694
Pair 4	Initial Brix (% SSC) & Brix (% SSC) after 11 days	20	.420	.065
Pair 5	Initial Brix (% SSC) & Brix (% SSC) after 12 days	20	-.021	.930

a. Grower line = 3

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.20500	1.16279	.26001	-.74920	.33920	-.788	19	.440
Pair 2	Initial Brix (% SSC) - Brix (% SSC) after 8 days	-1.06500	1.27868	.28592	-1.66344	-.46656	-3.725	19	.001
Pair 3	Initial Brix (% SSC) - Brix (% SSC) after 10 days	-.85000	1.16642	.26082	-1.39590	-.30410	-3.259	19	.004
Pair 4	Initial Brix (% SSC) - Brix (% SSC) after 11 days	-.83000	.81312	.18182	-1.21055	-.44945	-4.565	19	.000
Pair 5	Initial Brix (% SSC) - Brix (% SSC) after 12 days	-1.28500	.98209	.21960	-1.74463	-.82537	-5.851	19	.000

a. Grower line = 3

C6: Paired T-test for flesh firmness data collected along Supply Chain 2
C6-1: Paired T-test results for Grower line 1

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	2.6252	20	.18642	.04169
	Flesh firmness (kgf) after 3 days	2.3190	20	.11631	.02601
Pair 2	Flesh firmness (kgf) after 3 days	2.3190	20	.11631	.02601
	Flesh firmness (kgf) after 4 days	2.0412	20	.18586	.04156
Pair 3	Flesh firmness (kgf) after 4 days	2.0412	20	.18586	.04156
	Flesh firmness (kgf) after 5 days	1.9221	20	.15415	.03447
Pair 4	Flesh firmness (kgf) after 5 days	1.9221	20	.15415	.03447
	Flesh firmness (kgf) after 4 (1) days	2.1194	20	.15807	.03535
Pair 5	Flesh firmness (kgf) after 4 (1) days	2.1194	20	.15807	.03535
	Flesh firmness (kgf) after 7 days	1.0013	20	.18531	.04144

a. Grower line = 1

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	-.177	.455
Pair 2	Flesh firmness (kgf) after 3 days & Flesh firmness (kgf) after 4 days	20	-.018	.942
Pair 3	Flesh firmness (kgf) after 4 days & Flesh firmness (kgf) after 5 days	20	.092	.701
Pair 4	Flesh firmness (kgf) after 5 days & Flesh firmness (kgf) after 4 (1) days	20	.052	.826

Pair 5	Flesh firmness (kgf) after 4 (1) days & Flesh firmness (kgf) after 7 days	20	-.089	.709

a. Grower line = 1

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.30617	.23655	.05289	.19546	.41688	5.788	19	.000
Pair 2	Flesh firmness (kgf) after 3 days - Flesh firmness (kgf) after 4 days	.27782	.22098	.04941	.17440	.38124	5.623	19	.000
Pair 3	Flesh firmness (kgf) after 4 days - Flesh firmness (kgf) after 5 days	.11907	.23033	.05150	.01127	.22687	2.312	19	.032
Pair 4	Flesh firmness (kgf) after 5 days - Flesh firmness (kgf) after 4 (1) days	-.19731	.21492	.04806	-.29790	-.09673	-4.106	19	.001
Pair 5	Flesh firmness (kgf) after 4 (1) days - Flesh firmness (kgf) after 7 days	1.11810	.25406	.05681	.99920	1.23700	19.682	19	.000

a. Grower line = 1

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	2.6252	20	.18642	.04169
	Flesh firmness (kgf) after 3 days	2.3190	20	.11631	.02601
Pair 2	Initial flesh firmness (kgf)	2.6252	20	.18642	.04169
	Flesh firmness (kgf) after 4 days	2.0412	20	.18586	.04156
Pair 3	Initial flesh firmness (kgf)	2.6252	20	.18642	.04169
	Flesh firmness (kgf) after 5 days	1.9221	20	.15415	.03447
Pair 4	Initial flesh firmness (kgf)	2.6252	20	.18642	.04169
	Flesh firmness (kgf) after 4 (1) days	2.1194	20	.15807	.03535
Pair 5	Initial flesh firmness (kgf)	2.6252	20	.18642	.04169
	Flesh firmness (kgf) after 7 days	1.0013	20	.18531	.04144

a. Grower line = 1

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	-.177	.455
Pair 2	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 4 days	20	-.178	.452
Pair 3	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 5 days	20	.105	.659

		N	Correlation	Sig.
Pair 4	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 4 (1) days	20	.055	.817
Pair 5	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 7 days	20	-.019	.937

a. Grower line = 1

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.30617	.23655	.05289	.19546	.41688	5.788	19	.000
Pair 2	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 4 days	.58400	.28573	.06389	.45027	.71772	9.141	19	.000
Pair 3	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 5 days	.70306	.22905	.05122	.59586	.81026	13.727	19	.000
Pair 4	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 4 (1) days	.50575	.23765	.05314	.39453	.61698	9.517	19	.000
Pair 5	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 7 days	1.62385	.26534	.05933	1.49967	1.74804	27.369	19	.000

a. Grower line = 1

C6-2: Paired T-test results for Grower line 2

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	2.9302	20	.47662	.10657
	Flesh firmness (kgf) after 3 days	2.8043	20	.43564	.09741
Pair 2	Flesh firmness (kgf) after 3 days	2.8043	20	.43564	.09741
	Flesh firmness (kgf) after 4 days	2.5582	20	.36641	.08193
Pair 3	Flesh firmness (kgf) after 4 days	2.5582	20	.36641	.08193
	Flesh firmness (kgf) after 5 days	2.1534	20	.20131	.04501
Pair 4	Flesh firmness (kgf) after 5 days	2.1534	20	.20131	.04501
	Flesh firmness (kgf) after 4 (1) days	2.4426	20	.10357	.02316
Pair 5	Flesh firmness (kgf) after 4 (1) days	2.4426	20	.10357	.02316
	Flesh firmness (kgf) after 7 days	1.1011	20	.11171	.02498

a. Grower line = 2

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	-.142	.551
Pair 2	Flesh firmness (kgf) after 3 days & Flesh firmness (kgf) after 4 days	20	.185	.434

Pair 3	Flesh firmness (kgf) after 4 days & Flesh firmness (kgf) after 5 days	20	-.089	.708
Pair 4	Flesh firmness (kgf) after 5 days & Flesh firmness (kgf) after 4 (1) days	20	-.504	.023
Pair 5	Flesh firmness (kgf) after 4 (1) days & Flesh firmness (kgf) after 7 days	20	-.179	.449

a. Grower line = 2

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.12587	.68981	.15425	-.19697	.44871	.816	19	.425
Pair 2	Flesh firmness (kgf) after 3 days - Flesh firmness (kgf) after 4 days	.24607	.51467	.11508	.00520	.48694	2.138	19	.046
Pair 3	Flesh firmness (kgf) after 4 days - Flesh firmness (kgf) after 5 days	.40483	.43353	.09694	.20193	.60773	4.176	19	.001
Pair 4	Flesh firmness (kgf) after 5 days - Flesh firmness (kgf) after 4 (1) days	-.28916	.26884	.06011	-.41498	-.16334	-4.810	19	.000
Pair 5	Flesh firmness (kgf) after 4 (1) days - Flesh firmness (kgf) after 7 days	1.34149	.16540	.03698	1.26408	1.41890	36.272	19	.000

a. Grower line = 2

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	2.9302	20	.47662	.10657
	Flesh firmness (kgf) after 3 days	2.8043	20	.43564	.09741
Pair 2	Initial flesh firmness (kgf)	2.9302	20	.47662	.10657
	Flesh firmness (kgf) after 4 days	2.5582	20	.36641	.08193
Pair 3	Initial flesh firmness (kgf)	2.9302	20	.47662	.10657
	Flesh firmness (kgf) after 5 days	2.1534	20	.20131	.04501
Pair 4	Initial flesh firmness (kgf)	2.9302	20	.47662	.10657
	Flesh firmness (kgf) after 4 (1) days	2.4426	20	.10357	.02316
Pair 5	Initial flesh firmness (kgf)	2.9302	20	.47662	.10657
	Flesh firmness (kgf) after 7 days	1.1011	20	.11171	.02498

a. Grower line = 2

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	-.142	.551

		N	Correlation	Sig.
Pair 2	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 4 days	20	-.118	.621
Pair 3	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 5 days	20	.122	.609
Pair 4	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 4 (1) days	20	.013	.956
Pair 5	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 7 days	20	.386	.092

a. Grower line = 2

Paired Samples Test[a]

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.12587	.68981	.15425	-.19697	.44871	.816	19	.425
Pair 2 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 4 days	.37194	.63449	.14188	.07499	.66889	2.622	19	.017
Pair 3 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 5 days	.77677	.49425	.11052	.54545	1.00809	7.028	19	.000
Pair 4 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 4 (1) days	.48761	.48639	.10876	.25997	.71525	4.483	19	.000
Pair 5 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 7 days	1.82910	.44554	.09963	1.62058	2.03762	18.360	19	.000

a. Grower line = 2

C6-3: Paired T-test results for Grower line 3

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	3.3203	20	.58503	.13082
	Flesh firmness (kgf) after 3 days	2.9790	20	.53128	.11880
Pair 2	Flesh firmness (kgf) after 3 days	2.9790	20	.53128	.11880
	Flesh firmness (kgf) after 4 days	2.5356	20	.30433	.06805
Pair 3	Flesh firmness (kgf) after 4 days	2.5356	20	.30433	.06805
	Flesh firmness (kgf) after 5 days	2.2192	20	.19925	.04455
Pair 4	Flesh firmness (kgf) after 5 days	2.2192	20	.19925	.04455
	Flesh firmness (kgf) after 4 (1) days	2.4970	20	.37062	.08287
Pair 5	Flesh firmness (kgf) after 4 (1) days	2.4970	20	.37062	.08287
	Flesh firmness (kgf) after 7 days	1.1068	20	.10729	.02399

a. Grower line = 3

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	.428	.060

Pair 2	Flesh firmness (kgf) after 3 days & Flesh firmness (kgf) after 4 days	20	.160	.500
Pair 3	Flesh firmness (kgf) after 4 days & Flesh firmness (kgf) after 5 days	20	.215	.362
Pair 4	Flesh firmness (kgf) after 5 days & Flesh firmness (kgf) after 4 (1) days	20	-.224	.343
Pair 5	Flesh firmness (kgf) after 4 (1) days & Flesh firmness (kgf) after 7 days	20	-.448	.047

a. Grower line = 3

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.34133	.59871	.13388	.06112	.62153	2.550	19	.020
Pair 2	Flesh firmness (kgf) after 3 days - Flesh firmness (kgf) after 4 days	.44338	.56837	.12709	.17738	.70939	3.489	19	.002
Pair 3	Flesh firmness (kgf) after 4 days - Flesh firmness (kgf) after 5 days	.31638	.32588	.07287	.16386	.46890	4.342	19	.000
Pair 4	Flesh firmness (kgf) after 5 days - Flesh firmness (kgf) after 4 (1) days	-.27782	.45833	.10249	-.49233	-.06332	-2.711	19	.014
Pair 5	Flesh firmness (kgf) after 4 (1) days - Flesh firmness (kgf) after 7 days	1.39025	.42956	.09605	1.18921	1.59130	14.474	19	.000

a. Grower line = 3

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	3.3203	20	.58503	.13082
	Flesh firmness (kgf) after 3 days	2.9790	20	.53128	.11880
Pair 2	Initial flesh firmness (kgf)	3.3203	20	.58503	.13082
	Flesh firmness (kgf) after 4 days	2.5356	20	.30433	.06805
Pair 3	Initial flesh firmness (kgf)	3.3203	20	.58503	.13082
	Flesh firmness (kgf) after 5 days	2.2192	20	.19925	.04455
Pair 4	Initial flesh firmness (kgf)	3.3203	20	.58503	.13082
	Flesh firmness (kgf) after 4 (1) days	2.4970	20	.37062	.08287
Pair 5	Initial flesh firmness (kgf)	3.3203	20	.58503	.13082
	Flesh firmness (kgf) after 7 days	1.1068	20	.10729	.02399

a. Grower line = 3

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	.428	.060
Pair 2	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 4 days	20	.144	.545
Pair 3	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 5 days	20	.116	.625
Pair 4	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 4 (1) days	20	-.157	.509
Pair 5	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 7 days	20	-.372	.106

a. Grower line = 3

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.34133	.59871	.13388	.06112	.62153	2.550	19	.020
Pair 2	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 4 days	.78471	.61938	.13850	.49483	1.07459	5.666	19	.000
Pair 3	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 5 days	1.10109	.59567	.13320	.82231	1.37987	8.267	19	.000
Pair 4	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 4 (1) days	.82327	.73997	.16546	.47695	1.16958	4.976	19	.000
Pair 5	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 7 days	2.21352	.63287	.14151	1.91733	2.50971	15.642	19	.000

a. Grower line = 3

C7: Paired T-test results for Soluble solids content data collected along Supply Chain 2

C7-1: Paired T-test results for Grower line 1

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	9.3350	20	.95382	.21328
	Brix (% SSC) after 3 days	10.5950	20	.82109	.18360
Pair 2	Brix (% SSC) after 3 days	10.5950	20	.82109	.18360
	Brix (% SSC) after 4 days	10.6300	20	.94262	.21078
Pair 3	Brix (% SSC) after 4 days	10.6300	20	.94262	.21078
	Brix (% SSC) after 5 days	10.7100	20	.65767	.14706
Pair 4	Brix (% SSC) after 5 days	10.7100	20	.65767	.14706
	Brix (% SSC) after 4 (1) days	10.4100	20	.80191	.17931
Pair 5	Brix (% SSC) after 4 (1) days	10.4100	20	.80191	.17931
	Brix (% SSC) after 7 days	9.8300	20	.81635	.18254

a. Grower line = 1

Paired Samples Correlations[a]

	N	Correlation	Sig.

Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	-.482	.031
Pair 2	Brix (% SSC) after 3 days & Brix (% SSC) after 4 days	20	.340	.142
Pair 3	Brix (% SSC) after 4 days & Brix (% SSC) after 5 days	20	.014	.954
Pair 4	Brix (% SSC) after 5 days & Brix (% SSC) after 4 (1) days	20	.433	.057
Pair 5	Brix (% SSC) after 4 (1) days & Brix (% SSC) after 7 days	20	-.296	.205

a. Grower line = 1

Paired Samples Test[a]

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1 Initial Brix (% SSC) - Brix (% SSC) after 3 days	-1.26000	1.52950	.34201	-1.97583	-.54417	-3.684	19	.002
Pair 2 Brix (% SSC) after 3 days - Brix (% SSC) after 4 days	-.03500	1.01788	.22760	-.51138	.44138	-.154	19	.879
Pair 3 Brix (% SSC) after 4 days - Brix (% SSC) after 5 days	-.08000	1.14184	.25532	-.61440	.45440	-.313	19	.757
Pair 4 Brix (% SSC) after 5 days - Brix (% SSC) after 4 (1) days	.30000	.78673	.17592	-.06820	.66820	1.705	19	.104
Pair 5 Brix (% SSC) after 4 (1) days - Brix (% SSC) after 7 days	.58000	1.30287	.29133	-.02976	1.18976	1.991	19	.061

a. Grower line = 1

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	9.3350	20	.95382	.21328
	Brix (% SSC) after 3 days	10.5950	20	.82109	.18360
Pair 2	Initial Brix (% SSC)	9.3350	20	.95382	.21328
	Brix (% SSC) after 4 days	10.6300	20	.94262	.21078
Pair 3	Initial Brix (% SSC)	9.3350	20	.95382	.21328
	Brix (% SSC) after 5 days	10.7100	20	.65767	.14706
Pair 4	Initial Brix (% SSC)	9.3350	20	.95382	.21328
	Brix (% SSC) after 4 (1) days	10.4100	20	.80191	.17931
Pair 5	Initial Brix (% SSC)	9.3350	20	.95382	.21328
	Brix (% SSC) after 7 days	9.8300	20	.81635	.18254

a. Grower line = 1

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	-.482	.031
Pair 2	Initial Brix (% SSC) & Brix (% SSC) after 4 days	20	-.306	.190
Pair 3	Initial Brix (% SSC) & Brix (% SSC) after 5 days	20	.071	.767
Pair 4	Initial Brix (% SSC) & Brix (% SSC) after 4 (1) days	20	-.342	.139
Pair 5	Initial Brix (% SSC) & Brix (% SSC) after 7 days	20	.292	.212

a. Grower line = 1

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-1.26000	1.52950	.34201	-1.97583	-.54417	-3.684	19	.002
Pair 2	Initial Brix (% SSC) - Brix (% SSC) after 4 days	-1.29500	1.53228	.34263	-2.01213	-.57787	-3.780	19	.001
Pair 3	Initial Brix (% SSC) - Brix (% SSC) after 5 days	-1.37500	1.11962	.25036	-1.89900	-.85100	-5.492	19	.000
Pair 4	Initial Brix (% SSC) - Brix (% SSC) after 4 (1) days	-1.07500	1.44108	.32224	-1.74945	-.40055	-3.336	19	.003
Pair 5	Initial Brix (% SSC) - Brix (% SSC) after 7 days	-.49500	1.05903	.23681	-.99064	.00064	-2.090	19	.050

a. Grower line = 1

C7-2: Paired T-test results for Grower line 2

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.7450	20	1.05505	.23592
	Brix (% SSC) after 3 days	11.2300	20	.60966	.13632
Pair 2	Brix (% SSC) after 3 days	11.2300	20	.60966	.13632
	Brix (% SSC) after 4 days	11.0350	20	1.05195	.23522
Pair 3	Brix (% SSC) after 4 days	11.0350	20	1.05195	.23522
	Brix (% SSC) after 5 days	11.3300	20	.67598	.15115
Pair 4	Brix (% SSC) after 5 days	11.3300	20	.67598	.15115
	Brix (% SSC) after 4 (1) days	10.9800	20	1.01338	.22660
Pair 5	Brix (% SSC) after 4 (1) days	10.9800	20	1.01338	.22660
	Brix (% SSC) after 7 days	11.5900	20	.89437	.19999

a. Grower line = 2

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	.188	.426
Pair 2	Brix (% SSC) after 3 days & Brix (% SSC) after 4 days	20	.072	.762

		N	Correlation	Sig.
Pair 3	Brix (% SSC) after 4 days & Brix (% SSC) after 5 days	20	-.145	.541
Pair 4	Brix (% SSC) after 5 days & Brix (% SSC) after 4 (1) days	20	-.093	.697
Pair 5	Brix (% SSC) after 4 (1) days & Brix (% SSC) after 7 days	20	.204	.388

a. Grower line = 2

Paired Samples Test[a]

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1 Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.48500	1.11463	.24924	-1.00666	.03666	-1.946	19	.067
Pair 2 Brix (% SSC) after 3 days - Brix (% SSC) after 4 days	.19500	1.17718	.26323	-.35594	.74594	.741	19	.468
Pair 3 Brix (% SSC) after 4 days - Brix (% SSC) after 5 days	-.29500	1.33040	.29749	-.91765	.32765	-.992	19	.334
Pair 4 Brix (% SSC) after 5 days - Brix (% SSC) after 4 (1) days	.35000	1.26927	.28382	-.24404	.94404	1.233	19	.233
Pair 5 Brix (% SSC) after 4 (1) days - Brix (% SSC) after 7 days	-.61000	1.20695	.26988	-1.17487	-.04513	-2.260	19	.036

a. Grower line = 2

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.7450	20	1.05505	.23592
	Brix (% SSC) after 3 days	11.2300	20	.60966	.13632
Pair 2	Initial Brix (% SSC)	10.7450	20	1.05505	.23592
	Brix (% SSC) after 4 days	11.0350	20	1.05195	.23522
Pair 3	Initial Brix (% SSC)	10.7450	20	1.05505	.23592
	Brix (% SSC) after 5 days	11.3300	20	.67598	.15115
Pair 4	Initial Brix (% SSC)	10.7450	20	1.05505	.23592
	Brix (% SSC) after 4 (1) days	10.9800	20	1.01338	.22660
Pair 5	Initial Brix (% SSC)	10.7450	20	1.05505	.23592
	Brix (% SSC) after 7 days	11.5900	20	.89437	.19999

a. Grower line = 2

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	.188	.426
Pair 2	Initial Brix (% SSC) & Brix (% SSC) after 4 days	20	-.627	.003
Pair 3	Initial Brix (% SSC) & Brix (% SSC) after 5 days	20	-.127	.594
Pair 4	Initial Brix (% SSC) & Brix (% SSC) after 4 (1) days	20	-.274	.243
Pair 5	Initial Brix (% SSC) & Brix (% SSC) after 7 days	20	-.408	.074

a. Grower line = 2

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper			
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.48500	1.11463	.24924	-1.00666	.03666	-1.946	19	.067
Pair 2	Initial Brix (% SSC) - Brix (% SSC) after 4 days	-.29000	1.90066	.42500	-1.17954	.59954	-.682	19	.503
Pair 3	Initial Brix (% SSC) - Brix (% SSC) after 5 days	-.58500	1.32318	.29587	-1.20427	.03427	-1.977	19	.063
Pair 4	Initial Brix (% SSC) - Brix (% SSC) after 4 (1) days	-.23500	1.65092	.36916	-1.00766	.53766	-.637	19	.532
Pair 5	Initial Brix (% SSC) - Brix (% SSC) after 7 days	-.84500	1.63819	.36631	-1.61170	-.07830	-2.307	19	.032

a. Grower line = 2

C7-3: Paired T-test results for Grower line 3

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	9.0300	20	.59214	.13241
	Brix (% SSC) after 3 days	9.1700	20	.73991	.16545
Pair 2	Brix (% SSC) after 3 days	9.1700	20	.73991	.16545
	Brix (% SSC) after 4 days	9.4250	20	1.05325	.23551
Pair 3	Brix (% SSC) after 4 days	9.4250	20	1.05325	.23551
	Brix (% SSC) after 5 days	10.4800	20	.64775	.14484
Pair 4	Brix (% SSC) after 5 days	10.4800	20	.64775	.14484
	Brix (% SSC) after 4 (1) days	9.1350	20	.77070	.17233
Pair 5	Brix (% SSC) after 4 (1) days	9.1350	20	.77070	.17233
	Brix (% SSC) after 7 days	9.2300	20	.51718	.11564

a. Grower line = 3

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	.349	.131
Pair 2	Brix (% SSC) after 3 days & Brix (% SSC) after 4 days	20	-.175	.462
Pair 3	Brix (% SSC) after 4 days & Brix (% SSC) after 5 days	20	-.121	.611
Pair 4	Brix (% SSC) after 5 days & Brix (% SSC) after 4 (1) days	20	.083	.729
Pair 5	Brix (% SSC) after 4 (1) days & Brix (% SSC) after 7 days	20	-.081	.735

a. Grower line = 3

Paired Samples Test[a]

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper			

Pair 1 Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.14000	.76942	.17205	-.50010	.22010	-.814	19	.426
Pair 2 Brix (% SSC) after 3 days - Brix (% SSC) after 4 days	-.25500	1.38886	.31056	-.90500	.39500	-.821	19	.422
Pair 3 Brix (% SSC) after 4 days - Brix (% SSC) after 5 days	-1.05500	1.30161	.29105	-1.66417	-.44583	-3.625	19	.002
Pair 4 Brix (% SSC) after 5 days - Brix (% SSC) after 4 (1) days	1.34500	.96490	.21576	.89341	1.79659	6.234	19	.000
Pair 5 Brix (% SSC) after 4 (1) days - Brix (% SSC) after 7 days	-.09500	.96217	.21515	-.54531	.35531	-.442	19	.664

a. Grower line = 3

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	9.0300	20	.59214	.13241
	Brix (% SSC) after 3 days	9.1700	20	.73991	.16545
Pair 2	Initial Brix (% SSC)	9.0300	20	.59214	.13241
	Brix (% SSC) after 4 days	9.4250	20	1.05325	.23551
Pair 3	Initial Brix (% SSC)	9.0300	20	.59214	.13241
	Brix (% SSC) after 5 days	10.4800	20	.64775	.14484
Pair 4	Initial Brix (% SSC)	9.0300	20	.59214	.13241
	Brix (% SSC) after 4 (1) days	9.1350	20	.77070	.17233
Pair 5	Initial Brix (% SSC)	9.0300	20	.59214	.13241
	Brix (% SSC) after 7 days	9.2300	20	.51718	.11564

a. Grower line = 3

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	.349	.131
Pair 2	Initial Brix (% SSC) & Brix (% SSC) after 4 days	20	.513	.021
Pair 3	Initial Brix (% SSC) & Brix (% SSC) after 5 days	20	.111	.640
Pair 4	Initial Brix (% SSC) & Brix (% SSC) after 4 (1) days	20	.386	.093
Pair 5	Initial Brix (% SSC) & Brix (% SSC) after 7 days	20	-.058	.808

a. Grower line = 3

Paired Samples Test[a]

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper			
Pair 1 Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.14000	.76942	.17205	-.50010	.22010	-.814	19	.426
Pair 2 Initial Brix (% SSC) - Brix (% SSC) after 4 days	-.39500	.90581	.20255	-.81893	.02893	-1.950	19	.066
Pair 3 Initial Brix (% SSC) - Brix (% SSC) after 5 days	-1.45000	.82749	.18503	-1.83728	-1.06272	-7.836	19	.000

Pair 4	Initial Brix (% SSC) - Brix (% SSC) after 4 (1) days	-.10500	.76947	.17206	-.46512	.25512	-.610	19	.549
Pair 5	Initial Brix (% SSC) - Brix (% SSC) after 7 days	-.20000	.80851	.18079	-.57839	.17839	-1.106	19	.282

a. Grower line = 3

C8: Paired T-test results for flesh firmness data collected along Supply Chain 3
C8-1: Paired T-test results for Grower line 1

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	1.5898	20	.10220	.02285
	Flesh firmness (kgf) after 3 days	1.4107	20	.13093	.02928
Pair 2	Flesh firmness (kgf) after 3 days	1.4107	20	.13093	.02928
	Flesh firmness (kgf) after 5 days	1.1306	20	.12687	.02837
Pair 3	Flesh firmness (kgf) after 5 days	1.1306	20	.12687	.02837
	Flesh firmness (kgf) after 6 days	1.0659	20	.16585	.03708
Pair 4	Flesh firmness (kgf) after 6 days	1.0659	20	.16585	.03708
	Flesh firmness (kgf) after 7 days	.9979	20	.12552	.02807
Pair 5	Flesh firmness (kgf) after 7 days	.9979	20	.12552	.02807
	Flesh firmness (kgf) after 12 days	.5919	20	.07887	.01764

a. Grower line = 1

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	.121	.613
Pair 2	Flesh firmness (kgf) after 3 days & Flesh firmness (kgf) after 5 days	20	.063	.792
Pair 3	Flesh firmness (kgf) after 5 days & Flesh firmness (kgf) after 6 days	20	-.085	.722
Pair 4	Flesh firmness (kgf) after 6 days & Flesh firmness (kgf) after 7 days	20	.358	.122
Pair 5	Flesh firmness (kgf) after 7 days & Flesh firmness (kgf) after 12 days	20	.120	.613

a. Grower line = 1

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.17917	.15607	.03490	.10612	.25221	5.134	19	.000
Pair 2	Flesh firmness (kgf) after 3 days - Flesh firmness (kgf) after 5 days	.28009	.17649	.03946	.19749	.36269	7.098	19	.000

		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 3	Flesh firmness (kgf) after 5 days - Flesh firmness (kgf) after 6 days	.06464	.21719	.04857	-.03701	.16629	1.331	19	.199
Pair 4	Flesh firmness (kgf) after 6 days - Flesh firmness (kgf) after 7 days	.06804	.16844	.03766	-.01079	.14687	1.806	19	.087
Pair 5	Flesh firmness (kgf) after 7 days - Flesh firmness (kgf) after 12 days	.40596	.13998	.03130	.34045	.47148	12.970	19	.000

a. Grower line = 1

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	1.5898	20	.10220	.02285
	Flesh firmness (kgf) after 3 days	1.4107	20	.13093	.02928
Pair 2	Initial flesh firmness (kgf)	1.5898	20	.10220	.02285
	Flesh firmness (kgf) after 5 days	1.1306	20	.12687	.02837
Pair 3	Initial flesh firmness (kgf)	1.5898	20	.10220	.02285
	Flesh firmness (kgf) after 6 days	1.0659	20	.16585	.03708
Pair 4	Initial flesh firmness (kgf)	1.5898	20	.10220	.02285
	Flesh firmness (kgf) after 7 days	.9979	20	.12552	.02807
Pair 5	Initial flesh firmness (kgf)	1.5898	20	.10220	.02285
	Flesh firmness (kgf) after 12 days	.5919	20	.07887	.01764

a. Grower line = 1

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.17917	.15607	.03490	.10612	.25221	5.134	19	.000
Pair 2	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 5 days	.45926	.15167	.03391	.38828	.53024	13.542	19	.000
Pair 3	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 6 days	.52390	.15203	.03400	.45274	.59505	15.411	19	.000
Pair 4	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 7 days	.59193	.10936	.02445	.54075	.64312	24.206	19	.000
Pair 5	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 12 days	.99790	.12976	.02902	.93717	1.05863	34.391	19	.000

a. Grower line = 1

Paired Samples Test[a]

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			

Pair 1 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.17917	.15607	.03490	.10612	.25221	5.134	19	.000
Pair 2 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 5 days	.45926	.15167	.03391	.38828	.53024	13.542	19	.000
Pair 3 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 6 days	.52390	.15203	.03400	.45274	.59505	15.411	19	.000
Pair 4 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 7 days	.59193	.10936	.02445	.54075	.64312	24.206	19	.000
Pair 5 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 12 days	.99790	.12976	.02902	.93717	1.05863	34.391	19	.000

a. Grower line = 1

C8-2: Paired T-test results for Grower line 2

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	1.6499	20	.17160	.03837
	Flesh firmness (kgf) after 3 days	1.6193	20	.23780	.05317
Pair 2	Flesh firmness (kgf) after 3 days	1.6193	20	.23780	.05317
	Flesh firmness (kgf) after 5 days	1.4572	20	.12763	.02854
Pair 3	Flesh firmness (kgf) after 5 days	1.4572	20	.12763	.02854
	Flesh firmness (kgf) after 6 days	1.4333	20	.12522	.02800
Pair 4	Flesh firmness (kgf) after 6 days	1.4333	20	.12522	.02800
	Flesh firmness (kgf) after 7 days	1.1567	20	.09394	.02101
Pair 5	Flesh firmness (kgf) after 7 days	1.1567	20	.09394	.02101
	Flesh firmness (kgf) after 12 days	.9253	20	.12304	.02751

a. Grower line = 2

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	.240	.308
Pair 2	Flesh firmness (kgf) after 3 days & Flesh firmness (kgf) after 5 days	20	.074	.756
Pair 3	Flesh firmness (kgf) after 5 days & Flesh firmness (kgf) after 6 days	20	.237	.314
Pair 4	Flesh firmness (kgf) after 6 days & Flesh firmness (kgf) after 7 days	20	-.251	.286
Pair 5	Flesh firmness (kgf) after 7 days & Flesh firmness (kgf) after 12 days	20	-.042	.860

a. Grower line = 2

Paired Samples Test[a]

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1 Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.03062	.25767	.05762	-.08998	.15121	.531	19	.601

		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 2	Flesh firmness (kgf) after 3 days - Flesh firmness (kgf) after 5 days	.16216	.26143	.05846	.03981	.28451	2.774	19	.012
Pair 3	Flesh firmness (kgf) after 5 days - Flesh firmness (kgf) after 6 days	.02381	.15617	.03492	-.04928	.09690	.682	19	.504
Pair 4	Flesh firmness (kgf) after 6 days - Flesh firmness (kgf) after 7 days	.27669	.17438	.03899	.19508	.35830	7.096	19	.000
Pair 5	Flesh firmness (kgf) after 7 days - Flesh firmness (kgf) after 12 days	.23133	.15792	.03531	.15742	.30524	6.551	19	.000

a. Grower line = 2

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	1.6499	20	.17160	.03837
	Flesh firmness (kgf) after 3 days	1.6193	20	.23780	.05317
Pair 2	Initial flesh firmness (kgf)	1.6499	20	.17160	.03837
	Flesh firmness (kgf) after 5 days	1.4572	20	.12763	.02854
Pair 3	Initial flesh firmness (kgf)	1.6499	20	.17160	.03837
	Flesh firmness (kgf) after 6 days	1.4333	20	.12522	.02800
Pair 4	Initial flesh firmness (kgf)	1.6499	20	.17160	.03837
	Flesh firmness (kgf) after 7 days	1.1567	20	.09394	.02101
Pair 5	Initial flesh firmness (kgf)	1.6499	20	.17160	.03837
	Flesh firmness (kgf) after 12 days	.9253	20	.12304	.02751

a. Grower line = 2

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	.240	.308
Pair 2	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 5 days	20	-.414	.070
Pair 3	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 6 days	20	-.029	.903
Pair 4	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 7 days	20	.287	.220
Pair 5	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 12 days	20	-.142	.549

a. Grower line = 2

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.03062	.25767	.05762	-.08998	.15121	.531	19	.601
Pair 2	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 5 days	.19278	.25271	.05651	.07450	.31105	3.412	19	.003

Pair 3	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 6 days	.21659	.21534	.04815	.11581	.31737	4.498	19	.000
Pair 4	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 7 days	.49328	.17033	.03809	.41356	.57300	12.951	19	.000
Pair 5	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 12 days	.72461	.22493	.05030	.61934	.82988	14.407	19	.000

a. Grower line = 2

C8-3: Paired T-test for Grower line 3

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	1.5037	20	.14937	.03340
	Flesh firmness (kgf) after 3 days	1.3302	20	.16491	.03687
Pair 2	Flesh firmness (kgf) after 3 days	1.3302	20	.16491	.03687
	Flesh firmness (kgf) after 5 days	1.2292	20	.10238	.02289
Pair 3	Flesh firmness (kgf) after 5 days	1.2292	20	.10238	.02289
	Flesh firmness (kgf) after 6 days	1.1079	20	.08070	.01804
Pair 4	Flesh firmness (kgf) after 6 days	1.1079	20	.08070	.01804
	Flesh firmness (kgf) after 7 days	1.0194	20	.08690	.01943
Pair 5	Flesh firmness (kgf) after 7 days	1.0194	20	.08690	.01943
	Flesh firmness (kgf) after 12 days	.8539	20	.15299	.03421

a. Grower line = 3

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	.022	.926
Pair 2	Flesh firmness (kgf) after 3 days & Flesh firmness (kgf) after 5 days	20	-.275	.240
Pair 3	Flesh firmness (kgf) after 5 days & Flesh firmness (kgf) after 6 days	20	.205	.386
Pair 4	Flesh firmness (kgf) after 6 days & Flesh firmness (kgf) after 7 days	20	-.047	.844
Pair 5	Flesh firmness (kgf) after 7 days & Flesh firmness (kgf) after 12 days	20	-.072	.763

a. Grower line = 3

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.17350	.22004	.04920	.07051	.27648	3.526	19	.002

Pair 2	Flesh firmness (kgf) after 3 days - Flesh firmness (kgf) after 5 days	.10092	.21672	.04846	-.00050	.20235	2.083	19	.051
Pair 3	Flesh firmness (kgf) after 5 days - Flesh firmness (kgf) after 6 days	.12134	.11664	.02608	.06675	.17592	4.652	19	.000
Pair 4	Flesh firmness (kgf) after 6 days - Flesh firmness (kgf) after 7 days	.08845	.12133	.02713	.03166	.14524	3.260	19	.004
Pair 5	Flesh firmness (kgf) after 7 days - Flesh firmness (kgf) after 12 days	.16556	.18130	.04054	.08071	.25041	4.084	19	.001

a. Grower line = 3

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial flesh firmness (kgf)	1.5037	20	.14937	.03340
	Flesh firmness (kgf) after 3 days	1.3302	20	.16491	.03687
Pair 2	Initial flesh firmness (kgf)	1.5037	20	.14937	.03340
	Flesh firmness (kgf) after 5 days	1.2292	20	.10238	.02289
Pair 3	Initial flesh firmness (kgf)	1.5037	20	.14937	.03340
	Flesh firmness (kgf) after 6 days	1.1079	20	.08070	.01804
Pair 4	Initial flesh firmness (kgf)	1.5037	20	.14937	.03340
	Flesh firmness (kgf) after 7 days	1.0194	20	.08690	.01943
Pair 5	Initial flesh firmness (kgf)	1.5037	20	.14937	.03340
	Flesh firmness (kgf) after 12 days	.8539	20	.15299	.03421

a. Grower line = 3

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 3 days	20	.022	.926
Pair 2	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 5 days	20	-.027	.910
Pair 3	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 6 days	20	-.245	.298
Pair 4	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 7 days	20	.167	.480
Pair 5	Initial flesh firmness (kgf) & Flesh firmness (kgf) after 12 days	20	.276	.239

a. Grower line = 3

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 3 days	.17350	.22004	.04920	.07051	.27648	3.526	19	.002
Pair 2	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 5 days	.27442	.18335	.04100	.18861	.36023	6.693	19	.000

		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 3	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 6 days	.39576	.18636	.04167	.30854	.48298	9.497	19	.000
Pair 4	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 7 days	.48421	.15974	.03572	.40945	.55897	13.556	19	.000
Pair 5	Initial flesh firmness (kgf) - Flesh firmness (kgf) after 12 days	.64977	.18192	.04068	.56462	.73491	15.973	19	.000

a. Grower line = 3

C9: Paired T-test results for Soluble solids content (Brix) data collected along Supply Chain 3

C9-1: Paired T-tets results for Grower line 1

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.1850	20	1.08301	.24217
	Brix (% SSC) after 3 days	10.2150	20	.79622	.17804
Pair 2	Brix (% SSC) after 3 days	10.2150	20	.79622	.17804
	Brix (% SSC) after 5 days	10.8300	20	.32943	.07366
Pair 3	Brix (% SSC) after 5 days	10.8300	20	.32943	.07366
	Brix (% SSC) after 6 days	11.0000	20	.38933	.08706
Pair 4	Brix (% SSC) after 6 days	11.0000	20	.38933	.08706
	Brix (% SSC) after 7 days	11.2900	20	.37822	.08457
Pair 5	Brix (% SSC) after 7 days	11.2900	20	.37822	.08457
	Brix (% SSC) after 12 days	11.9200	20	.51565	.11530

a. Grower line = 1

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	-.075	.752
Pair 2	Brix (% SSC) after 3 days & Brix (% SSC) after 5 days	20	.179	.451
Pair 3	Brix (% SSC) after 5 days & Brix (% SSC) after 6 days	20	.000	1.000
Pair 4	Brix (% SSC) after 6 days & Brix (% SSC) after 7 days	20	.404	.077
Pair 5	Brix (% SSC) after 7 days & Brix (% SSC) after 12 days	20	-.026	.914

a. Grower line = 1

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.03000	1.39174	.31120	-.68136	.62136	-.096	19	.924
Pair 2	Brix (% SSC) after 3 days - Brix (% SSC) after 5 days	-.61500	.80543	.18010	-.99195	-.23805	-3.415	19	.003
Pair 3	Brix (% SSC) after 5 days - Brix (% SSC) after 6 days	-.17000	.51001	.11404	-.40869	.06869	-1.491	19	.152
Pair 4	Brix (% SSC) after 6 days - Brix (% SSC) after 7 days	-.29000	.41915	.09372	-.48617	-.09383	-3.094	19	.006

		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 5	Brix (% SSC) after 7 days - Brix (% SSC) after 12 days	-.63000	.64734	.14475	-.93297	-.32703	-4.352	19	.000

a. Grower line = 1

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.1850	20	1.08301	.24217
	Brix (% SSC) after 3 days	10.2150	20	.79622	.17804
Pair 2	Initial Brix (% SSC)	10.1850	20	1.08301	.24217
	Brix (% SSC) after 5 days	10.8300	20	.32943	.07366
Pair 3	Initial Brix (% SSC)	10.1850	20	1.08301	.24217
	Brix (% SSC) after 6 days	11.0000	20	.38933	.08706
Pair 4	Initial Brix (% SSC)	10.1850	20	1.08301	.24217
	Brix (% SSC) after 7 days	11.2900	20	.37822	.08457
Pair 5	Initial Brix (% SSC)	10.1850	20	1.08301	.24217
	Brix (% SSC) after 12 days	11.9200	20	.51565	.11530

a. Grower line = 1

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	-.075	.752
Pair 2	Initial Brix (% SSC) & Brix (% SSC) after 5 days	20	-.170	.474
Pair 3	Initial Brix (% SSC) & Brix (% SSC) after 6 days	20	.196	.408
Pair 4	Initial Brix (% SSC) & Brix (% SSC) after 7 days	20	-.089	.709
Pair 5	Initial Brix (% SSC) & Brix (% SSC) after 12 days	20	-.015	.952

a. Grower line = 1

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.03000	1.39174	.31120	-.68136	.62136	-.096	19	.924
Pair 2	Initial Brix (% SSC) - Brix (% SSC) after 5 days	-.64500	1.18432	.26482	-1.19928	-.09072	-2.436	19	.025
Pair 3	Initial Brix (% SSC) - Brix (% SSC) after 6 days	-.81500	1.07668	.24075	-1.31890	-.31110	-3.385	19	.003
Pair 4	Initial Brix (% SSC) - Brix (% SSC) after 7 days	-1.10500	1.17852	.26353	-1.65657	-.55343	-4.193	19	.000
Pair 5	Initial Brix (% SSC) - Brix (% SSC) after 12 days	-1.73500	1.20624	.26972	-2.29954	-1.17046	-6.432	19	.000

a. Grower line = 1

C9-2: Paired T-test results for Grower line 2

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.0450	20	.67549	.15104
	Brix (% SSC) after 3 days	10.1300	20	.45085	.10081

Pair 2	Brix (% SSC) after 3 days	10.1300	20	.45085	.10081
	Brix (% SSC) after 5 days	10.5750	20	.28447	.06361
Pair 3	Brix (% SSC) after 5 days	10.5750	20	.28447	.06361
	Brix (% SSC) after 6 days	10.9800	20	.47639	.10652
Pair 4	Brix (% SSC) after 6 days	10.9800	20	.47639	.10652
	Brix (% SSC) after 7 days	11.2100	20	.31937	.07141
Pair 5	Brix (% SSC) after 7 days	11.2100	20	.31937	.07141
	Brix (% SSC) after 12 days	12.0000	20	.36128	.08079

a. Grower line = 2

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	-.058	.807
Pair 2	Brix (% SSC) after 3 days & Brix (% SSC) after 5 days	20	.207	.381
Pair 3	Brix (% SSC) after 5 days & Brix (% SSC) after 6 days	20	-.004	.987
Pair 4	Brix (% SSC) after 6 days & Brix (% SSC) after 7 days	20	.133	.577
Pair 5	Brix (% SSC) after 7 days & Brix (% SSC) after 12 days	20	.233	.324

a. Grower line = 2

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.08500	.83368	.18642	-.47518	.30518	-.456	19	.654
Pair 2	Brix (% SSC) after 3 days - Brix (% SSC) after 5 days	-.44500	.48065	.10748	-.66995	-.22005	-4.140	19	.001
Pair 3	Brix (% SSC) after 5 days - Brix (% SSC) after 6 days	-.40500	.55581	.12428	-.66513	-.14487	-3.259	19	.004
Pair 4	Brix (% SSC) after 6 days - Brix (% SSC) after 7 days	-.23000	.53715	.12011	-.48139	.02139	-1.915	19	.071
Pair 5	Brix (% SSC) after 7 days - Brix (% SSC) after 12 days	-.79000	.42290	.09456	-.98792	-.59208	-8.354	19	.000

a. Grower line = 2

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.0450	20	.67549	.15104
	Brix (% SSC) after 3 days	10.1300	20	.45085	.10081
Pair 2	Initial Brix (% SSC)	10.0450	20	.67549	.15104
	Brix (% SSC) after 5 days	10.5750	20	.28447	.06361
Pair 3	Initial Brix (% SSC)	10.0450	20	.67549	.15104
	Brix (% SSC) after 6 days	10.9800	20	.47639	.10652
Pair 4	Initial Brix (% SSC)	10.0450	20	.67549	.15104
	Brix (% SSC) after 7 days	11.2100	20	.31937	.07141
Pair 5	Initial Brix (% SSC)	10.0450	20	.67549	.15104
	Brix (% SSC) after 12 days	12.0000	20	.36128	.08079

a. Grower line = 2

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	-.058	.807
Pair 2	Initial Brix (% SSC) & Brix (% SSC) after 5 days	20	.039	.870
Pair 3	Initial Brix (% SSC) & Brix (% SSC) after 6 days	20	.088	.712
Pair 4	Initial Brix (% SSC) & Brix (% SSC) after 7 days	20	-.095	.691
Pair 5	Initial Brix (% SSC) & Brix (% SSC) after 12 days	20	.457	.043

a. Grower line = 2

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.08500	.83368	.18642	-.47518	.30518	-.456	19	.654
Pair 2	Initial Brix (% SSC) - Brix (% SSC) after 5 days	-.53000	.72264	.16159	-.86821	-.19179	-3.280	19	.004
Pair 3	Initial Brix (% SSC) - Brix (% SSC) after 6 days	-.93500	.79158	.17700	-1.30547	-.56453	-5.282	19	.000
Pair 4	Initial Brix (% SSC) - Brix (% SSC) after 7 days	-1.16500	.77410	.17309	-1.52729	-.80271	-6.730	19	.000
Pair 5	Initial Brix (% SSC) - Brix (% SSC) after 12 days	-1.95500	.60304	.13484	-2.23723	-1.67277	-14.498	19	.000

a. Grower line = 2

C9-3: Paired T-test results for Grower line 3

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.6200	20	.47306	.10578
	Brix (% SSC) after 3 days	10.7650	20	.49765	.11128
Pair 2	Brix (% SSC) after 3 days	10.7650	20	.49765	.11128
	Brix (% SSC) after 5 days	10.9150	20	.33916	.07584
Pair 3	Brix (% SSC) after 5 days	10.9150	20	.33916	.07584
	Brix (% SSC) after 6 days	11.0150	20	.38151	.08531
Pair 4	Brix (% SSC) after 6 days	11.0150	20	.38151	.08531
	Brix (% SSC) after 7 days	11.1600	20	.38580	.08627
Pair 5	Brix (% SSC) after 7 days	11.1600	20	.38580	.08627
	Brix (% SSC) after 12 days	11.9550	20	.47515	.10625

a. Grower line = 3

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	-.346	.136
Pair 2	Brix (% SSC) after 3 days & Brix (% SSC) after 5 days	20	-.199	.399

Pair 3	Brix (% SSC) after 5 days & Brix (% SSC) after 6 days	20	-.262	.264
Pair 4	Brix (% SSC) after 6 days & Brix (% SSC) after 7 days	20	.040	.867
Pair 5	Brix (% SSC) after 7 days & Brix (% SSC) after 12 days	20	.185	.435

a. Grower line = 3

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.14500	.79636	.17807	-.51771	.22771	-.814	19	.426
Pair 2	Brix (% SSC) after 3 days - Brix (% SSC) after 5 days	-.15000	.65574	.14663	-.45690	.15690	-1.023	19	.319
Pair 3	Brix (% SSC) after 5 days - Brix (% SSC) after 6 days	-.10000	.57308	.12814	-.36821	.16821	-.780	19	.445
Pair 4	Brix (% SSC) after 6 days - Brix (% SSC) after 7 days	-.14500	.53161	.11887	-.39380	.10380	-1.220	19	.237
Pair 5	Brix (% SSC) after 7 days - Brix (% SSC) after 12 days	-.79500	.55391	.12386	-1.05424	-.53576	-6.419	19	.000

a. Grower line = 3

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Initial Brix (% SSC)	10.6200	20	.47306	.10578
	Brix (% SSC) after 3 days	10.7650	20	.49765	.11128
Pair 2	Initial Brix (% SSC)	10.6200	20	.47306	.10578
	Brix (% SSC) after 5 days	10.9150	20	.33916	.07584
Pair 3	Initial Brix (% SSC)	10.6200	20	.47306	.10578
	Brix (% SSC) after 6 days	11.0150	20	.38151	.08531
Pair 4	Initial Brix (% SSC)	10.6200	20	.47306	.10578
	Brix (% SSC) after 7 days	11.1600	20	.38580	.08627
Pair 5	Initial Brix (% SSC)	10.6200	20	.47306	.10578
	Brix (% SSC) after 12 days	11.9550	20	.47515	.10625

a. Grower line = 3

Paired Samples Correlations[a]

		N	Correlation	Sig.
Pair 1	Initial Brix (% SSC) & Brix (% SSC) after 3 days	20	-.346	.136
Pair 2	Initial Brix (% SSC) & Brix (% SSC) after 5 days	20	.195	.410
Pair 3	Initial Brix (% SSC) & Brix (% SSC) after 6 days	20	.054	.822
Pair 4	Initial Brix (% SSC) & Brix (% SSC) after 7 days	20	.454	.044
Pair 5	Initial Brix (% SSC) & Brix (% SSC) after 12 days	20	-.174	.464

a. Grower line = 3

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Initial Brix (% SSC) - Brix (% SSC) after 3 days	-.14500	.79636	.17807	-.51771	.22771	-.814	19	.426
Pair 2	Initial Brix (% SSC) - Brix (% SSC) after 5 days	-.29500	.52563	.11753	-.54100	-.04900	-2.510	19	.021
Pair 3	Initial Brix (% SSC) - Brix (% SSC) after 6 days	-.39500	.59159	.13228	-.67187	-.11813	-2.986	19	.008
Pair 4	Initial Brix (% SSC) - Brix (% SSC) after 7 days	-.54000	.45468	.10167	-.75280	-.32720	-5.311	19	.000
Pair 5	Initial Brix (% SSC) - Brix (% SSC) after 12 days	-1.33500	.72640	.16243	-1.67497	-.99503	-8.219	19	.000

a. Grower line = 3

C10: One-way ANOVA results for Supply Chain 1

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Initial flesh firmness (kgf)	Between Groups	5.201	2	2.601	17.419	.000
	Within Groups	8.510	57	.149		
	Total	13.711	59			
Flesh firmness (kgf) after 3 days	Between Groups	3.282	2	1.641	27.306	.000
	Within Groups	3.425	57	.060		
	Total	6.707	59			
Flesh firmness (kgf) after 8 days	Between Groups	2.955	2	1.478	34.720	.000
	Within Groups	2.426	57	.043		
	Total	5.381	59			
Flesh firmness (kgf) after 10 days	Between Groups	1.374	2	.687	32.503	.000
	Within Groups	1.205	57	.021		
	Total	2.580	59			
Flesh firmness (kgf) after 11 days	Between Groups	.889	2	.444	34.331	.000
	Within Groups	.738	57	.013		
	Total	1.627	59			
Flesh firmness (kgf) after 12 days	Between Groups	.240	2	.120	14.155	.000
	Within Groups	.483	57	.008		
	Total	.723	59			

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Initial Brix (% SSC)	Between Groups	5.204	2	2.602	5.678	.006
	Within Groups	26.122	57	.458		
	Total	31.326	59			
Brix (% SSC) after 3 days	Between Groups	3.408	2	1.704	1.815	.172
	Within Groups	53.519	57	.939		
	Total	56.927	59			
Brix (% SSC) after 8 days	Between Groups	4.808	2	2.404	3.424	.039
	Within Groups	40.021	57	.702		
	Total	44.829	59			
Brix (% SSC) after 10 days	Between Groups	5.586	2	2.793	3.984	.024
	Within Groups	39.959	57	.701		
	Total	45.546	59			
Brix (% SSC) after 11 days	Between Groups	44.113	2	22.056	44.518	.000
	Within Groups	28.241	57	.495		
	Total	72.354	59			
Brix (% SSC) after 12 days	Between Groups	6.252	2	3.126	5.025	.010
	Within Groups	35.458	57	.622		
	Total	41.710	59			

C11: One-way ANOVA results for Supply Chain 2

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Initial flesh firmness (kgf)	Between Groups	4.856	2	2.428	12.056	.000
	Within Groups	11.479	57	.201		
	Total	16.335	59			
Flesh firmness (kgf) after 3 days	Between Groups	4.677	2	2.339	14.449	.000
	Within Groups	9.226	57	.162		
	Total	13.903	59			
Flesh firmness (kgf) after 4 days	Between Groups	3.416	2	1.708	19.599	.000
	Within Groups	4.967	57	.087		
	Total	8.382	59			

Flesh firmness (kgf) after 5 days	Between Groups	.974	2	.487	14.050	.000
	Within Groups	1.976	57	.035		
	Total	2.950	59			
Flesh firmness (kgf) after 4 (1) days	Between Groups	1.667	2	.833	14.445	.000
	Within Groups	3.288	57	.058		
	Total	4.955	59			
Flesh firmness (kgf) after 7 days	Between Groups	.141	2	.070	3.619	.033
	Within Groups	1.108	57	.019		
	Total	1.249	59			

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Initial Brix (% SSC)	Between Groups	33.482	2	16.741	21.160	.000
	Within Groups	45.097	57	.791		
	Total	78.579	59			
Brix (% SSC) after 3 days	Between Groups	44.516	2	22.258	41.908	.000
	Within Groups	30.273	57	.531		
	Total	74.790	59			
Brix (% SSC) after 4 days	Between Groups	28.054	2	14.027	13.555	.000
	Within Groups	58.985	57	1.035		
	Total	87.039	59			
Brix (% SSC) after 5 days	Between Groups	7.732	2	3.866	8.860	.000
	Within Groups	24.872	57	.436		
	Total	32.604	59			
Brix (% SSC) after 4 (1) days	Between Groups	35.697	2	17.849	23.651	.000
	Within Groups	43.016	57	.755		
	Total	78.713	59			
Brix (% SSC) after 7 days	Between Groups	60.181	2	30.091	52.066	.000
	Within Groups	32.942	57	.578		
	Total	93.123	59			

C12: One-way ANOVA results for Supply Chain 3

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Initial flesh firmness (kgf)	Between Groups	.216	2	.108	5.215	.008
	Within Groups	1.182	57	.021		
	Total	1.398	59			
Flesh firmness (kgf) after 3 days	Between Groups	.891	2	.445	13.246	.000
	Within Groups	1.917	57	.034		
	Total	2.808	59			
Flesh firmness (kgf) after 5 days	Between Groups	1.122	2	.561	39.270	.000
	Within Groups	.814	57	.014		
	Total	1.937	59			
Flesh firmness (kgf) after 6 days	Between Groups	1.618	2	.809	48.830	.000
	Within Groups	.944	57	.017		
	Total	2.562	59			
Flesh firmness (kgf) after 7 days	Between Groups	.297	2	.148	13.847	.000
	Within Groups	.611	57	.011		
	Total	.907	59			
Flesh firmness (kgf) after 12 days	Between Groups	1.232	2	.616	41.298	.000
	Within Groups	.851	57	.015		
	Total	2.083	59			

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Initial Brix (% SSC)	Between Groups	3.596	2	1.798	2.911	.063
	Within Groups	35.207	57	.618		
	Total	38.803	59			
Brix (% SSC) after 3 days	Between Groups	4.753	2	2.376	6.572	.003
	Within Groups	20.613	57	.362		
	Total	25.366	59			
Brix (% SSC) after 5 days	Between Groups	1.252	2	.626	6.170	.004
	Within Groups	5.785	57	.101		
	Total	7.037	59			

Brix (% SSC) after 6 days	Between Groups	.012	2	.006	.035	.965
	Within Groups	9.958	57	.175		
	Total	9.970	59			
Brix (% SSC) after 7 days	Between Groups	.172	2	.086	.655	.523
	Within Groups	7.484	57	.131		
	Total	7.656	59			
Brix (% SSC) after 12 days	Between Groups	.064	2	.032	.155	.857
	Within Groups	11.822	57	.207		
	Total	11.886	59			

APPENDIX D: Modelling results for the three supply chains

D1: Firmness loss models fitted to the data collected along the supply chains

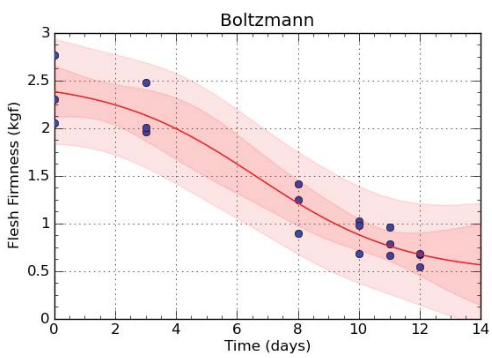
Supply chain 1

Name: Boltzmann
Kind: Regression
Family: Custom
Equation: $FF = A + ((\Delta A)/ (1+\exp((t-t_k)/\lambda)))$
Independent variables: 1
Standard Error: 0.224060
Coefficient of Determination (r^2): 0.920767
Correlation Coefficient (r): 0.959566
Degree of Freedom: 14
Parameters

	Value	Std Err	Range (95% confidence)
A	0.469253	0.370882	-0.326211 to 1.264716
ΔA	-1.566749	0.981551	-3.671965 to 0.538468
t_k	6.646961	1.177983	4.120439 to 9.173483
λ	2.433608	1.351782	-0.465675 to 5.332892

Covariance matrix:

	A	ΔA	t_k	λ
A	2.739946	7.036364	-3.284074	-8.819828
ΔA	7.036364	19.190896	-3.782609	-25.138343
t_k	-3.284074	-3.782609	27.640620	-1.065437
λ	-8.819828	-25.138343	-1.065437	36.398456

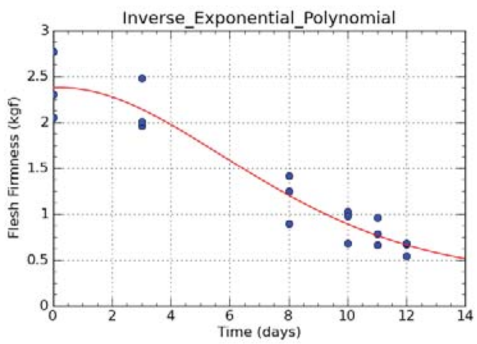


Name: Inverse Exponential Polynomial
Kind: Regression
Family: Custom
Equation: $FF = \delta/ (1+\exp(\beta_0+\beta_1(t)+\beta_2(t^2)+\beta_3(t^3)))$
Independent variables: 1
Standard Error: 0.240998
Coefficient of Determination (r^2): 0.92143
Correlation Coefficient (r): 0.959912
Degree of Freedom: 12
Parameters:

	Value	Std Err	Range (95% confidence)
δ	11.963335	379.575164	-815.059902 to 838.986573
β_0	41.942402	123108911.12	-268231233.071737 to 268231316.956542
β_1	-0.278903	818623.773262	-1783628.258753 to 1783627.700947
β_2	0.575471	1689093.376561	-3680217.743879 to 3680218.894821
β_3	-0.021005	61652.596754	-134329.489796 to 134329.447786

Covariance matrix:

	δ	β_0	β_1	β_2	β_3
δ	2480665.61	-886243741819.61	5893256227.41	-12159829247.69	443839582.63
β_0	-886249115428.3	-26094659296272205	1735187831675705.2	-3580270167409204	130681320506770.58
β_1	5893291960.04	1735187831773048.5	-11538287496664.18	23807328377344.33	-868977190144.4
β_2	-12159902976.25	-3580270167686878.5	23807328377855.17	-49122444264463.51	1792989238989.88
β_3	443842273.76	130681320517751.39	-868977190168.67	1792989239001.48	-65444838083.37

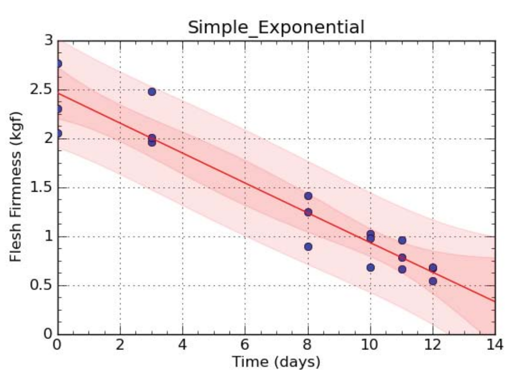


Name: Simple Exponential
Kind: Regression
Family: Custom
Equation: FF= A_0+A_1 exp(-λ*t)
Independent variables: 1
Standard Error: 0.229719
Coefficient of Determination (r^2): 0.910766
Correlation Coefficient (r): 0.954340
Degree of Freedom: 15
Parameters:

	Value	Std Err	Range (95% confidence)
A_0	-98.855809	3772.893191	-8140.587287 to 7942.875669
A_1	101.317716	3772.827424	-7940.273583 to 8142.909015
λ	0.001521	0.057159	-0.120312 to 0.123354

Covariance matrix:

	A_0	A_1	λ
A_0	269745754.76	-269741052.61	4086.65
A_1	-269741052.61	269736350.74	-4086.57
Λ	4086.65	-4086.57	0.0619

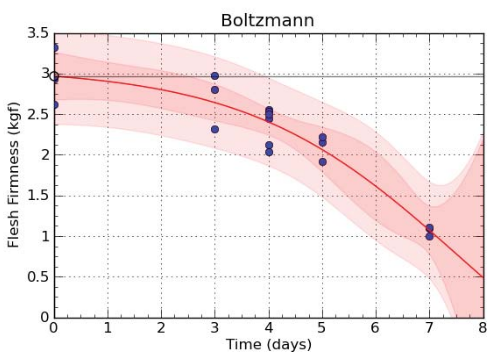


Supply chain 2
Name: Boltzmann
Kind: Regression
Family:Custom
Equation: FF= A + ((ΔA)/ (1+exp((t-t_k)/λ)))
Independent Variables:1
Standard Error: 0.240573
Correlation Coeff. (r): 0.942301
Coeff. of Determination (r^2): 0.887931
DOF: 14
Parameters

	Value	Std Err	Range (95% confidence)
A	-1.595029	11.208174	-25.634173 to 22.444114
ΔA	-6.260142	22.702474	-54.952106 to 42.431822
t_k	7.575489	8.697202	-11.078154 to 26.229132
λ	1.992843	2.282287	-2.902176 to 6.887862

Covariance matrix:

	A	ΔA	t_k	λ
A	2170.576164	4396.396408	-1683.370358	-434.977241
ΔA	4396.396408	8905.363403	-3409.392613	-882.165401
t_k	-1683.370358	-3409.392613	1306.966299	337.926842
λ	-434.977241	-882.165401	337.926842	90.000681

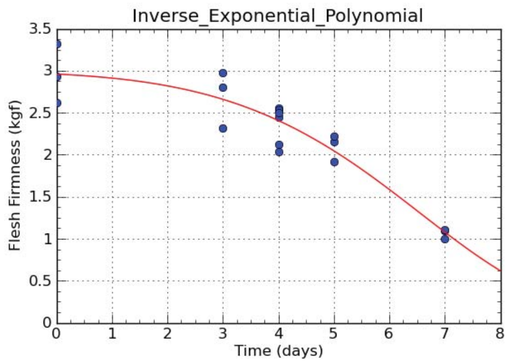


Name: Inverse Exponential Polynomial
Kind: Regression
Family: Custom
Equation: FF= δ/ (1+exp(β_0+β_1(t)+β_2(t^2)+β_3(t^3)))
Independent variables: 1
Standard Error: 0.25999
Correlation Coeff. (r): 0.942236
Coeff. of Determination (r^2): 0.887809
DOF: 12
Parameters:

	Value	Std Err	Range (95% confidence)
δ	5.23353	232.11	-500.491 to 510.958
β_0	-26.483556	903908688.824	-1969447874.539609 to 1969447821.572497
β_1	2.714025	92630046.415300	-201823530.827948 to 201823536.255999
β_2	0.745450	25443287.129849	-55436159.681874 to 55436161.172775
β_3	0.308707	10536249.526518	-22956515.336206 to 22956515.953619

Covariance matrix:

	δ	β_0	β_1	β_2	β_3
δ	-797028.576069	-3489367816640	357581736530	98219052948.5	40673310650.375
β_0	3489323035551	-12087449754395478	12386882057407749	34023840967425446	14089519034425629
β_1	357577147433.1	1238688205521045000	-12693731944155299	-34866685172447716	-14438546925370754
β_2	98217792443.50	340238409657911170	-34866685176957872	-9577055356086924	-3965928005055469
β_3	40672788661.21	140895190318624100	-14438546925305280	-3965928004524475	-1642319518265594

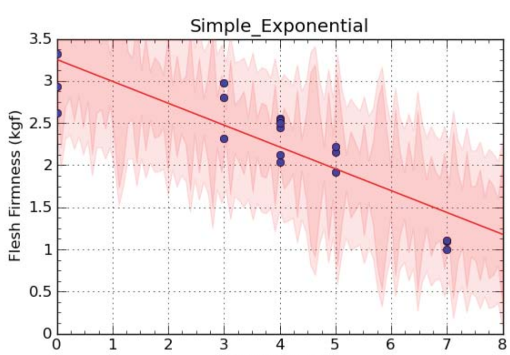


Name: Simple Exponential
Kind: Regression
Family: Custom
Equation: $FF= A_0+A_1 \exp(-\lambda*t)$
Independent variables: 1
Standard Error: 0.346820
Correlation Coeff. (r): 0.866283
Coeff. of Determination (r^2): 0.750447
DOF: 15
Parameters:

	Value	Std Err	Range (95% confidence)
A_0	-698.290189	220759.415673	-471235.846404 to 469839.266026
A_1	701.545261	220759.315159	-469835.796714 to 471238.887235
λ	0.000370	0.116683	-0.248334 to 0.249074

Covariance matrix:

	A_0	A_1	λ
A_0	405163485222.341740	-405163300747.267820	214150.333264
A_1	-405163300747.267760	405163116272.516170	-214150.235691
λ	214150.333264	-214150.235691	0.113190



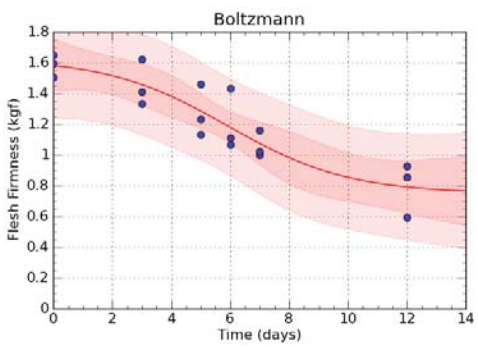
Supply chain 3

Name: Boltzmann
Kind: Regression
Family: Custom
Equation: $FF= A + ((\Delta A)/ (1+\exp((t-t_k)/\lambda)))$
Independent variables: 1
Standard Error: 0.139311
Coefficient of Determination (r^2): 0.814454
Correlation Coefficient (r): 0.902471
Degree of freedom: 14
Parameters

	Value	Std Err	Range (95% confidence)
A	0.746308	0.139212	0.447728 to 1.044889
ΔA	-0.133010	0.385096	-0.958959 to 0.692938
t_k	5.921092	0.889569	4.013156 to 7.829028
λ	2.046365	1.307980	-0.758972 to 4.851703

Covariance matrix:

	A	ΔA	t_k	λ
A	0.998577	2.595920	-2.472562	-6.955844
ΔA	2.595920	7.641259	-1.667156	-22.665401
t_k	-2.472562	-1.667156	40.774305	-4.827714
λ	-6.955844	-22.665401	-4.827714	88.151387

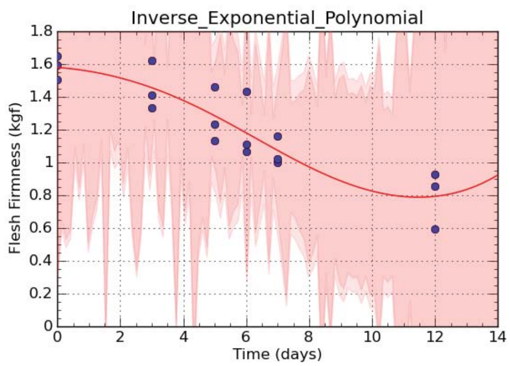


Name: Inverse Exponential Polynomial
Kind: Regression
Family: Custom
Equation: $FF= \delta/ (1+\exp(\beta_0+\beta_1(t)+\beta_2(t^2)+\beta_3(t^3)))$
Independent variables: 1
Standard Error: 0.150398
Coefficient of Determination (r^2): 0.814640
Correlation Coefficient (r): 0.902574
Degree of Freedom: 12
Parameters:

	Value	Std Err	Range (95% confidence)
Δ	1.878856	4.570118	-8.078576 to 11.836288
β_0	-38.411677	74202153.979298	-161672643.490431 to 161672566.667078
β_1	1.267051	2447643.105398	-5332954.933428 to 5332957.467529
β_2	0.828342	1600156.015978	-3486439.628734 to 3486441.285418
β_3	-0.051322	99141.986661	-216011.883817 to 216011.781172

Covariance matrix:

	Δ	β_0	β_1	β_2	β_3
δ	923.361776	5726704437.75	-188906090.632813	-123494094.75	7651428.950928
β_0	5726709473.62	243416521716724160	-8029372991795730	-5249233219270678	325230417914800.19
β_1	-188906256.75	-8029372991766572	264858072049514.72	173151974809876.87	-10728098138979.98
β_2	-123494203.34	-5249233219279222	173151974810787.53	113198763980808.75	-7013535078152.25
β_3	7651435.67	325230417915203.87	-10728098139032.26	-7013535078149.54	434542503492.74

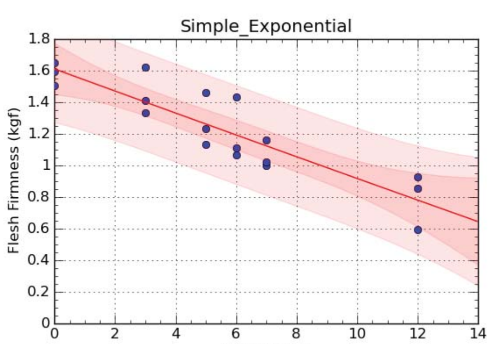


Name: Simple_Exponential
Kind: Regression
Family: Custom
Equation: $FF= A_0+A_1 \exp(-\lambda*t)$
Independent variables: 1
Standard Error: 0.139856
Coefficient of Determination (r^2): 0.799644
Correlation Coefficient (r): 0.894228
Degree of Freedom: 15
Parameters:

	Value	Std Err	Range (95% confidence)
A_0	-32.580151	984.744728	-2131.513854 to 2066.353551
A_1	34.188674	984.697233	-2064.643796 to 2133.021144
λ	0.002049	0.059754	-0.125315 to 0.129413

Covariance matrix:

	A_0	A_1	λ
A_0	49577832.507830	-49575441.252073	3008.362156
A_1	-49575441.252073	49573050.293062	-3008.216387
Λ	3008.362156	-3008.216387	0.182550



D2:Storage potential models developed for data collected along the supply chains

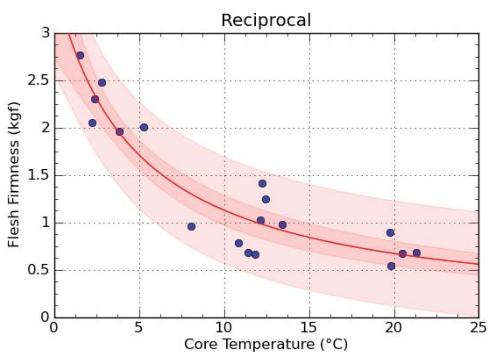
Supply chain 1

Name: Reciprocal
Kind: Regression
Family: Yield-Density Models
Equation: FF= 1/(a + b*T)
Independent variables: 1
Standard Error: 0.254653
Coefficient of Determination (r^2): 0.881940
Correlation Coefficient (r): 0.939117
Degree of Freedom: 16
Parameters:

	Value	Std Err	Range (95% confidence
a	0.282381	0.030401	0.217935 to 0.346828
b	0.060381	0.007873	0.043690 to 0.077071

Covariance matrix:

	a	B
a	0.014252	-0.002834
b	-0.002834	0.000956



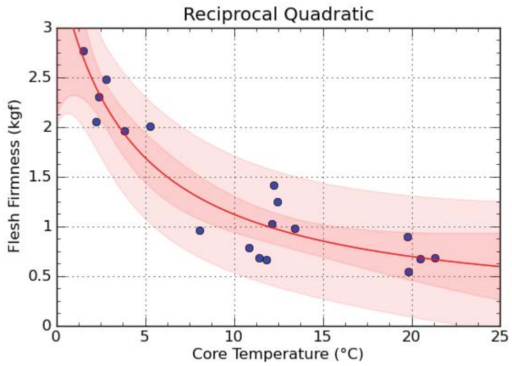
Name: Reciprocal Quadratic
Kind: Regression
Family: Yield-Density Models
Equation: FF = 1/(a + b*T + c*T^2)
Independent Variables: 1
Standard Error: 0.26253
Correlation Coeff. (r): 0.939344
Coeff. of Determination (r^2): 0.882366
DOF: 15

Parameters:

	Values	Std Err	Range (95% confidence)
a	0.271912	0.0545884	0.155559 to 0.388264
b	0.0657851	0.0242745	0.0140453 to 0.117525
c	-0.000366604	0.0015109	-0.00358702 to 0.00285381

Covariance matrix:

	a	B	c
a	0.0432359	-0.0176877	0.000985439
b	-0.0176877	0.00854955	-0.000502385
c	0.000985	-0.000502	0.000033

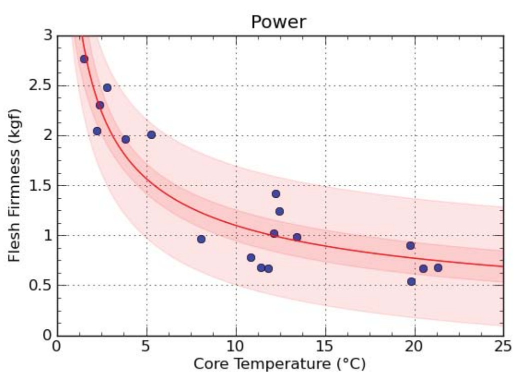


Name: Power
Kind: Regression
Family: Power Law Family
Equation: FF = a*T^b
Independent Variables: 1
Standard Error: 0.270512
Correlation Coeff. (r): 0.931009
Coeff. of Determination (r^2): 0.866777
DOF: 16
Parameters:

	Value	Std Err	Range (95% confidence)
a	3.577663	0.289430	2.964099 to 4.191227
b	-0.512505	0.051994	-0.622728 to -0.402282

Covariance matrix:

	a	B
a	1.144755	-0.174634
b	-0.174634	0.036943



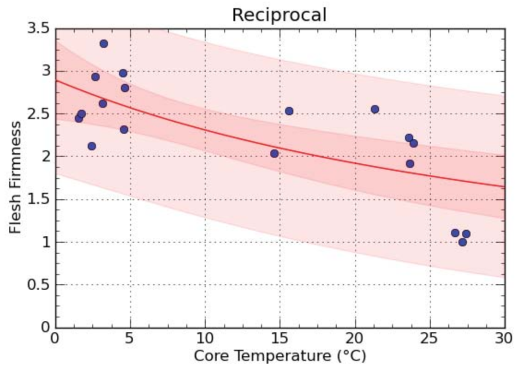
Supply chain 2
Name: Reciprocal
Kind: Regression
Family: Yield-Density Models
Equation: FF = 1/(a + b*T)
Independent Variables: 1
Standard Error: 0.469779
Correlation Coeff. (r): 0.715266
Coeff. of Determination (r^2): 0.511605
DOF: 16

Parameters:

	Value	Std Err	Range (95% confidence)
a	0.345400	0.025935	0.290419 to 0.400380
b	0.008777	0.002621	0.003221 to 0.014334

Covariance matrix:

	a	B
a	0.003048	-0.000202
b	-0.000202	0.000031



Name: Power
Kind: Regression
Family: Power Law Family
Equation: FF = a*T^b
Independent Variables: 1
Standard Error: 0.523211
Correlation Coeff. (r): 0.627844
Coeff. of Determination (r^2): 0.394188
DOF: 16
Parameters:

	Value	Std Err	Range (95% confidence)
a	3.120273	0.330403	2.419850 to 3.820695
b	-0.160441	0.052387	-0.271496 to -0.049386

Covariance matrix:

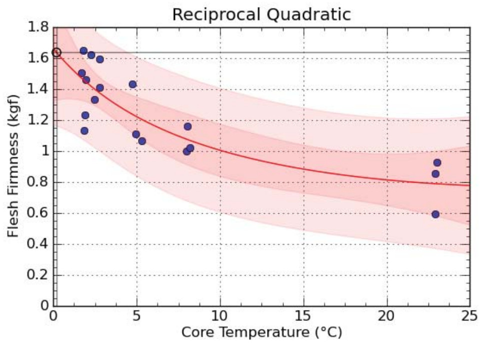
	a	B
a	0.398780	-0.054478
b	-0.054478	0.010025

Supply chain 3
Name: Reciprocal Quadratic
Kind: Regression
Family: Yield-Density Models
Equation: y = 1/(a + b*T + c*T^2)
Independent Variables: 1
Standard Error: 0.170314
Correlation Coeff. (r): 0.838376
Coeff. of Determination (r^2): 0.702874
DOF: 15
Parameters:

	Values	Std Err	Range (95% confidence)
a	0.602694	0.0578569	0.479374 to 0.726013
b	0.0473725	0.0211689	0.00225211 to 0.0924928
c	-0.000796291	0.000936301	-0.00279197 to 0.00119939

Covariance matrix:

	a	B	c
a	0.115402	-0.0379321	0.00150752
b	-0.0379321	0.0154489	-0.000646012
c	0.001508	-0.000646	0.000030

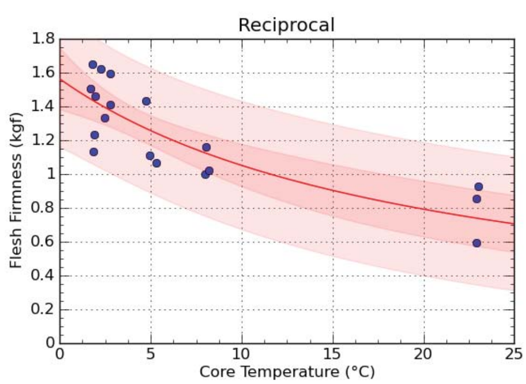


Name: Reciprocal
Kind: Regression
Family: Yield-Density Models
Equation: FF = 1/(a + b*T)
Independent Variables: 1
Standard Error: 0.16895
Correlation Coeff. (r): 0.82953
Coeff. of Determination (r^2): 0.688121
DOF: 16
Parameters:

	Value	Std Err	Range (95% confidence)
a	0.640675	0.035512	0.565392 to 0.715959
b	0.031223	0.007392	0.015552 to 0.046893

Covariance matrix:

	a	B
a	0.044182	-0.006742
b	-0.006742	0.001914



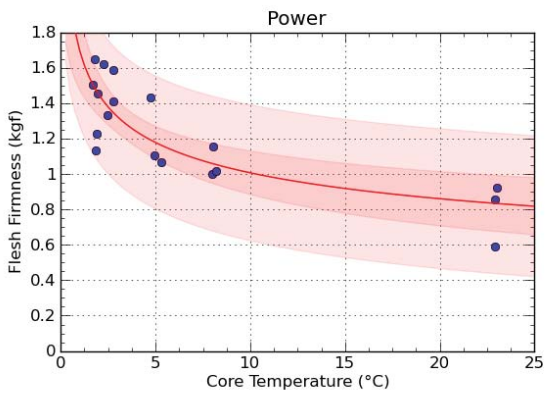
Name: Power
Kind: Regression
Family: Power Law Family

Equation: y = a*T^b
Independent Variables: 1
Standard Error: 0.171678
Correlation Coeff. (r): 0.823388
Coeff. of Determination (r^2): 0.677968
DOF: 16
Parameters:

	Value	Std Err	Range (95% confidence
a	1.69705	0.104736	1.47502 to 1.91908
b	-0.226764	0.043451	-0.318875 to -0.134652

Covariance matrix:

	a	B
a	0.372186	-0.131403
b	-0.131403	0.064057



APPENDIX E: Packing materials details

Packing components

1. International tray- PLB

Description: Single layer tray incorporating a corrugated cardboard body with an integral lid, and corrugated cardboard end pieces.

Supplier: Carter Holt Harvey Packaging Ltd.

Code: ZESPRI® GREEN Kiwifruit

Dimensions (millimeters):

	Length	**Width**	**Depth**
Internal	471 (±2)	292 (±2)	64 (±0.5)
External	498 (±2)	300 (±2)	70 (±1)

Construction: By approved tray former using a specified hot melt adhesive (National PLB-99 or Advance PLB- 99)

2. Pocket Pack- Plastic

Description: PET, PP – pocket pack to fit International trays, Modular and Plateau size packs

Supplier: Alto packing Ltd.

Colour: White

Material: Polyethyleneterapthalate (PET) or Polypropylene Plastic (PP)

Dimensions (millimeters):

Length - 470±3

Width - 290±1

3. Polyliner

Description: Flat sheets

Suppliers: Bay Trade Supplies.

Material: High Density Polyethylene (HDPE)

Colour: Natural

Dimensions (millimeters):

Length- 950

Width- 880

Tolerance- (+20, -0)

Gauge- 10µm

APPENDIX F: ZESPRI GRADE STANDARDS