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Curing Kiwifruit: Physical, Physiological and Storage Impacts

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ABSTRACT

Curing of 'Hayward' kiwifruit is a postharvest approach to reduce decay and maintain quality during long-term storage. Curing occurs immediately after harvest, with fruit placed in picking bins in a covered packhouse space for a few days. Curing contributes to fruit quality by allowing the picking scar to heal (resulting in reduced *Botrytis* rot) and allows a proportion of water loss, resulting in fruit cells that are less turgid and hence less prone to mechanical damage during packing. In the contemporary packhouse, curing is also used to buffer logistical challenges, since stockpiling fruit has advantages in ensuring the packing line continues to process fruit. In kiwifruit, the rates of cooling to storage temperature have previously been identified as an influence on long-term storage outcomes, including firmness and storage breakdown development (SBD). Little is known about how curing contributes to long-term storage, yet there is potential to impact post-storage fruit quality given that curing occurs immediately prior to packing and cooling. There is a lack of knowledge regarding the range of conditions which fruit are exposed to when bins are stacked under non-controlled conditions. It is also unknown how these conditions may influence fruit quality (i.e. fruit softening and SBD development) after long-term storage. This thesis incorporates monitoring of within bin environmental conditions to assess possible in-stack heterogeneity during curing.

The spatial-temporal variability of temperature and relative humidity (RH) in the curing stack and its effect on fruit weight loss are described for five different trials. At-harvest fruit temperature had the dominant effect on temperature variability in the stack, regardless of other environmental conditions. The temperature variability throughout the stack was 5-8 °C, with the effect of the initial picking temperature lasting up to approximately 24 h after harvest. The temperature variability in the whole stack reduced with increasing curing period, when bin position had a greater influence on temperature heterogeneity in the stack. The highest temperature was recorded at the top of the stack, resulting in a temperature difference between 2 to 5 °C between layers. One possible explanation for this phenomenon is thermal stratification under the packhouse canopy.

Under real conditions, RH increased to saturation ($\geq 97\%$ measured) a few (3-7) hours after the start of curing. Fruit weight loss was between approximately 0.3-0.5% over 2 to 3 days. Under the assumption that weight loss can be attributed to water loss, during saturated RH conditions in the bin, there would be a very low driving force for water loss, resulting in the low weight loss observed in the whole stack. Despite the low range of fruit weight loss, an

influence of at-harvest temperature and also bin position on weight loss could be discerned within each trial.

Controlled simulated curing conditions that mimicked real curing conditions were investigated with respect to long-term storage fruit outcomes. Fruit exposed to > 17.4 °C (with $> 64\%$ RH) for 4 days were consistently the firmest and had the lowest incidence of SBD after 100 days of storage. However, the effect of source-orchard on fruit quality outcomes were not suppressed by curing conditions. The range of fruit weight loss (0.6-1%) in fruit exposed > 17.4 °C (with $> 64\%$ RH) for 4 days was double that measured in industry.

These results suggest that the interaction of time and temperature during curing significantly influence fruit quality in long-term storage. Curing at > 17.4 °C (with $> 64\%$ RH) for 4 days was observed to be the best curing treatment to prepare fruit for long-term storage. However, the quantity of weight loss during curing may be an issue as grower payments are made on a mass basis which is first measured after curing when fruit enter the packing line. Applying curing at > 17.4 °C and $\approx 80\%$ RH (ambient conditions) for 4 days is likely to happen in the industry situation during the months of March and mid-May, without needing the large monetary investments for controlled conditions at the packhouse.

The results of this study have potential implications for the kiwifruit industry. Environmental conditions during curing and the consequent spatial and temporal variability in the stack impact fruit weight loss and possibly post-storage quality outcomes. Applying curing under controlled conditions would allow reduction of variability, necessarily for late harvest fruit. Controlling curing conditions could favour maintenance of fruit quality in kiwifruit batches destined for long-term storage and also reduce curing imparted variability.

Further research is required to understand the mechanism of curing and to determine whether the beneficial effect of curing at > 17.4 °C and $> 64\%$ RH for 4 days occurred because of the effect of temperature on biochemical reactions on the cell wall or the effect of the physical process driven by the water loss.

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خواب و دست به سانی جان و می گوید

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رومی

TABLE OF CONTENTS

TABLE OF CONTENTS	1
LIST OF FIGURES	5
LIST OF TABLES	11
CHAPTER 1	14
1 General introduction	14
1.1 Literature review	15
1.2 Kiwifruit industry importance in NZ	15
1.3 Fruit maturity in kiwifruit	17
1.3.1 Maturity, ripening, and ethylene	18
1.4 Key factors in fruit loss in the kiwifruit industry	19
1.4.1 Softening	20
1.4.2 Storage breakdown disorder	23
1.4.2.1 Factors affecting SBD incidence in kiwifruit	25
1.4.3 <i>Botrytis cinerea</i>	28
1.5 Transpiration and respiration	29
1.5.1 Water relationship and transpiration in kiwifruit	33
1.5.2 Temperature	35
1.5.3 Relative humidity	36
1.6 Temperature management of supply chain	38
1.6.1 Curing-Delayed cooling	38
1.6.1.1 Curing effect on postharvest diseases and disorders	39
1.6.1.2 Curing effect on fruit quality	40
1.6.2 Precooling	41
1.6.2.1 Rapid cooling	41
1.6.2.2 Passive cooling	42
1.7 Research questions and objectives	43
CHAPTER 2	46
2 Part A-Survey of real industrial conditions	46
2.1 Introduction	46
2.2 Materials and methods	48
2.2.1 Location and local weather condition	48
2.2.2 Fruit bins	50

2.2.3	Bin set-up in orchard.....	51
2.2.4	Packhouse structure	52
2.2.5	Environmental conditions monitoring at the packhouse.....	55
2.2.6	Curing time	55
2.2.7	Fruit weight loss.....	56
2.2.8	Curing conditions.....	56
2.3	Curing trial one.....	57
2.3.1	Trial commentary.....	57
2.3.2	Fruit source	58
2.3.3	Trial method specifics.....	58
2.3.4	Results.....	59
2.3.4.1	Time variability of curing.....	59
2.3.4.2	Ambient conditions during curing.....	59
2.3.4.3	Temperature during curing	61
2.3.4.4	Relative humidity during curing.....	62
2.3.4.5	Weight loss impact as a result of curing.....	64
2.4	Curing trial two	65
2.4.1	Trial commentary.....	65
2.4.2	Fruit source	66
2.4.3	Trial method specifics.....	66
2.4.4	Results.....	67
2.4.4.1	Time variability of curing.....	67
2.4.4.2	Ambient conditions during curing.....	67
2.4.4.3	Temperature during curing	69
2.4.4.4	Relative humidity during curing.....	70
2.4.4.5	Weight loss impact as a result of curing.....	72
2.5	Curing trial three	75
2.5.1	Trial commentary.....	75
2.5.2	Fruit source	76
2.5.3	Trial method specifics.....	76
2.5.4	Results.....	77
2.5.4.1	Time variability of curing.....	77
2.5.4.2	Ambient conditions during curing.....	78
2.5.4.3	Temperature during curing	79
2.5.4.4	Relative humidity during curing.....	82
2.5.4.5	Weight loss impact as a result of curing.....	86
2.6	Curing trial four.....	87
2.6.1	Trial commentary.....	87
2.6.2	Fruit source	87
2.6.3	Trial method specifics.....	88
2.6.4	Results.....	88
2.6.4.1	Time variability of curing.....	88
2.6.4.2	Ambient conditions during curing.....	89
2.6.4.3	Temperature during curing	91

2.6.4.4	Relative humidity during curing.....	92
2.6.4.5	Weight loss impact as a result of curing.....	94
2.7	Curing trial five.....	95
2.7.1	Trial commentary.....	95
2.7.2	Fruit source.....	96
2.7.3	Trial method specifics.....	96
2.7.4	Results.....	97
2.7.4.1	Time variability of curing.....	97
2.7.4.2	Ambient conditions during curing.....	98
2.7.4.3	Temperature during curing.....	99
2.7.4.4	Relative humidity during curing.....	101
2.7.4.5	Weight loss impact as a result of curing.....	102
2.8	Discussion.....	104
2.8.1	Initial picking temperature.....	104
2.8.2	Ambient conditions during curing.....	105
2.8.3	Logistical constraints and bin stacking issues.....	106
2.8.4	Effect of bin design on environmental conditions in the bin.....	109
2.8.5	Environmental conditions and weight loss.....	110
2.9	Conclusion.....	112
CHAPTER 3.....		113
3	Part B-Effects of curing on ‘Hayward’ storage outcomes.....	113
3.1	Introduction.....	113
3.2	Materials and methods.....	115
3.2.1	Objectives.....	115
3.2.2	Fruit source.....	115
3.2.3	Postharvest evaluation.....	116
3.2.4	Curing (delayed cooling) simulation and storage time.....	116
3.2.5	Assessment methods.....	118
3.2.5.1	Fruit Firmness.....	118
3.2.5.2	Soluble solids content.....	118
3.2.5.3	Dry matter.....	118
3.2.5.4	SBD scoring.....	119
3.2.5.5	Decay incidence.....	120
3.2.5.6	Data analysis.....	120
3.2.5.7	Experiment commentary.....	120
3.3	Results.....	120
3.3.1	The designed curing condition profile.....	120
3.3.2	Fruit quality attributes at harvest.....	124
3.3.3	Fruit weight loss during curing.....	125
3.3.4	Effect of curing on fruit firmness after storage.....	125
3.3.5	Effect of curing on SBD development during storage period.....	130

3.3.6	Effect of curing on rot incidence during storage period	132
3.4	Discussion	133
3.4.1	The effect of fruit weight loss during curing on fruit quality	133
3.4.2	The effect of curing condition on fruit quality.....	134
3.5	Conclusion.....	140
CHAPTER 4	142
4	General discussion, conclusions, and future work	142
4.1	Effect of temperature variability during curing on fruit weight loss.....	142
4.2	Effect of curing on fruit quality and the possible mechanisms	145
4.3	Industry implications.....	149
4.4	Future work	153
4.5	Recommendation to improve the experimental conditions in future	156
4.6	Conclusion.....	156
REFERENCES	160

LIST OF FIGURES

Figure 1.1: Schematic representation of kiwifruit softening, showing the timing of the main physiological events (Atkinson <i>et al.</i> 2011).....	21
Figure 2.1: The yellow triangle depicts the location of the local weather station.	49
Figure 2.2: (a) Local temperature and (b) precipitation data have been recorded by the local weather station with multiple temperature sensors (green, grey and red lines) during the months that the trials have been conducted from March to June in 2016.	49
Figure 2.3: The percentage of hours in which the mean wind direction is from each of the four cardinal directions (North, East, South, and West), excluding hours in which the mean wind speed is less than 2 kph. The lightly tinted areas at the boundaries are the percentage of hours spent in the implied intermediate directions (Northeast, Southeast, Southwest, and Northwest) (Anonymous, 2017a).....	50
Figure 2.4: (a) Typical harvesting wooden and (b) plastic bins which were used in the packhouse have been labelled to track them during curing.	50
Figure 2.5: (a) An XSense HiTag logger, (b) a balance has been placed at the back of a vehicle at the orchard, (c) the middle fruit bags with a logger within each, (d) the position of the top and the middle bags in the relevant bin, (e) a set of three wooden bins ready to be loaded on a truck, (f) the bins being loaded on a track to transport to the packhouse.	52
Figure 2.6: (a) The packhouse diagrams including the side view and (b) the plan.	53
Figure 2.7: Inside-view of the canopy and different sides of the canopy: (a) the North wall, (b) the South side, (c) the West side and (d) the East side.	54
Figure 2.8: (a) Bin handling under the canopy the truck's arrival at the packhouse to off-load bins, (b) a stack of labelled wooden bins, (c) bins stack arrangement under the canopy, (d) the bin dump area, (e) the bins being tagged off and the fruit bags and the loggers retrieved before the bin being tipped on a conveyor belt, (f) the fruit bags were weighed at the packhouse.	55
Figure 2.9: Illustration of an aerial view of bin stacking pattern for the first trial. The blue colour depicts the stacked bins for monitoring temperature and RH during curing.	59
Figure 2.10: Duration of time in curing stack as influenced by position in stacked bins. Each block represents a single bin - a cross-sectional side view of the stack.....	59

Figure 2.11: Temperature and precipitation recorded by the local weather station for three days from 30 th March to 1 st April 2016.	60
Figure 2.12: Ambient conditions under the canopy around the curing stack during the commercial kiwifruit curing, measured at 6 location at 1.5 m height. The black vertical lines represent the time scale of the curing.	60
Figure 2.13: Spatial temporal temperature variation of the middle of 250 kg ‘Hayward’ kiwifruit bins during commercial curing. Maps (a-e) represent the bins interpolation and the histograms (f-j) the frequency of temperature value in the monitored stack (n = 14).	62
Figure 2.14: Spatial temporal RH variation of the middle of 250 kg ‘Hayward’ kiwifruit bins during commercial curing. Maps (a-d) represent the bins interpolation and the histograms (e-h) the frequency of RH value in the monitored stack (n = 14). ...	63
Figure 2.15: Weight loss of measured fruit on top (a, c) and in the middle (b, d) of 250 kg ‘Hayward’ kiwifruit bins during commercial curing (n = 18). Each block represents a single bin.	64
Figure 2.16: Illustration of an aerial view of bin stacking pattern for the second trial. The blue colour depicts the stacked bins for monitoring temperature and RH during curing.	66
Figure 2.17: Duration of time in curing stack as influenced by position in stacked bins. Each block represents a single bin - a cross-sectional side view of the stack.....	67
Figure 2.18: Temperature and precipitation data have been recorded at the local weather station for three days from 18 th April to 20 th April 2016.....	68
Figure 2.19: Ambient conditions under the canopy around the curing stack during the commercial kiwifruit curing, measured at 6 locations at 1.5 m and 6 m heights. The black vertical lines represent the time scale of the curing.	68
Figure 2.20: A cross sectional view of spatial temporal temperature variation of the middle of 320 kg ‘Hayward’ kiwifruit bins during commercial curing. The maps on the left labelled from (a-1) to (d-1) represent data for the primary row including interpolation (n = 72) and the maps on the right labelled from (a-2) to (d-2) represent data for the secondary row including interpolation (n = 74), while histograms report data from both rows (n = 146).	70
Figure 2.21: Spatial temporal RH variation of the middle of 320 kg ‘Hayward’ kiwifruit bins during commercial curing. The maps on the left labelled from (a-1) to (f-1) represent data for the primary row including interpolation (n = 72) and the maps on the right labelled from (a-2) to (f-2) represent data for the secondary row including interpolation (n = 74), while histograms report data from both rows (n = 146).	71

Figure 2.22: Illustration of an aerial view of bin stacking pattern for the third trial. The blue colour depicts the stacked bins for monitoring temperature and RH during curing.	77
Figure 2.23: Duration of time in curing stack as influenced by position in stacked bins. Each block represents a single bin - a cross-sectional side view of the stack.....	77
Figure 2.24: Temperature and precipitation data have been recorded at the local weather station for three days from 9 th May to 11 th May 2016.	78
Figure 2.25: Ambient conditions under the canopy around the curing stack during the commercial kiwifruit curing, measured at 6 locations at 1.5 m and 6 m height. The black vertical lines represent the time scale of the curing.	79
Figure 2.26: Spatial temporal temperature variation of the middle of 250 kg ‘Hayward’ kiwifruit bins. The maps on the left labelled from (a-1) to (e-1) represent data for the primary row including interpolation (n = 104) after the first 31 h of curing. The maps on the right labelled from (a-2) to (e-2) represent data for the secondary row including interpolation (n = 46) after the 26 h of curing, while histograms report data from both rows (n = 150).	81
Figure 2.27: Spatial temporal temperature variation of the middle of 250 kg ‘Hayward’ kiwifruit bins after 59 h curing. The maps on the left labelled from (a-1) to (e) represent data for the primary row only including interpolation (n = 104) after 59 h curing. The maps on the right labelled from (a-2) to (b-2) represent data for the secondary row only including interpolation (n = 46) after at least 40.7 h curing, while histograms report data from both rows (n = 150).	82
Figure 2.28: Spatial temporal RH variation of the middle of 250 kg ‘Hayward’ kiwifruit bins. The maps on the left labelled from (a-1) to (f-1) represent data for the primary row only including interpolation (n = 104) after the first 28 h of curing. The maps on the right labelled from (a-2) to (f-2) represent data for the secondary row including interpolation (n = 46) after the first 23 h of curing, while histograms report data from both rows (n = 150).	84
Figure 2.29: Spatial temporal RH variation of the middle of 250 kg ‘Hayward’ kiwifruit bins. The maps on the left labelled from (a-1) to (f) represent data for the primary row only including interpolation (n = 104) after 59 h curing. The maps on the right labelled from (a-2) to (d-2) represent data for the secondary row including interpolation (n = 46) after 40.7 h curing, while histograms report data from both rows (n = 150).	85
Figure 2.30: Weight loss of measured fruit on top (a, c, e) and in middle (b, d, f) of 250 kg ‘Hayward’ kiwifruit during commercial curing (n = 59).	86

Figure 2.31: Illustration of an aerial view of bin stacking pattern for the fourth trial. The blue colour depicts the stacked bins for monitoring temperature and RH during curing.	88
Figure 2.32: Duration of time in curing stack as influenced by position in stacked bins. Each block represents a single bin - a cross-sectional side view of the stack.....	89
Figure 2.33: Temperature and precipitation data have been recorded at the local weather station for three days from 23 rd May to 25 th May 2016.	90
Figure 2.34: Ambient conditions under the canopy around the curing stack during the commercial kiwifruit curing, measured at 6 location at 1.5 m and 6 m height. The black vertical lines represent the time scale of the curing.	90
Figure 2.35: Spatial temperature variation of the middle of 320 kg ‘Hayward’ kiwifruit bins after 6 h curing. Maps (a-d) represent data for the row including interpolation (n = 38) and also histograms (e-h) represent the frequency of temperature value in the same row.	92
Figure 2.36: Spatial RH variation of the middle of 320 kg ‘Hayward’ kiwifruit bins after 6 h curing. Maps (a-c) represent data for the row including interpolation (n = 38) and also histograms (d-f) represent the frequency of RH in the same row.....	93
Figure 2.37: Weight loss of measured fruit on top (a) and in middle (b) of 320 kg ‘Hayward’ kiwifruit during commercial curing (n = 13).	94
Figure 2.38: Illustration of an aerial view of bin stacking pattern for the fifth trial. The blue colour depicts the stacked bins for monitoring temperature and RH during curing.	97
Figure 2.39: Duration of time in curing stack as influenced by position in stacked bins. Each block represents a single bin - a cross-sectional side view of the stack.....	97
Figure 2.40: Temperature and precipitation data have been recorded at the local weather station for a week from 13 th June to 19 th June 2016.	98
Figure 2.41: Ambient conditions under the canopy around the curing stack during commercial kiwifruit curing, measured at 6 locations at both 1.5 m and 6 m heights.	99
Figure 2.42: Spatial temporal temperature variation of the middle of 320 kg ‘Hayward’ kiwifruit bins during commercial curing. The maps on the left labelled from (a) to (f-1) represent the primary row only including interpolation (n = 117) after 73 h curing, the maps on the right labelled from (c-2) to (f-2) represent data for the secondary row including interpolation (n = 74) after at least 50 h curing, while the histograms report data from both rows (n = 191).	100

- Figure 2.43: Spatial temporal RH variation of the middle of 320 kg ‘Hayward’ kiwifruit bins during commercial curing. The maps on the left labelled from (a-1) to (d-1) represent the primary row only including interpolation (n = 117) after 73 h curing, the maps on the right labelled from (a-2) to (d-2) represent data for the secondary row including interpolation (n = 74) after at least 50 h curing, while the histograms report data from both rows (n = 191). 102
- Figure 2.44: Weight loss of measured fruit on top (a, c) and in the middle (b, d) of 320 kg ‘Hayward’ kiwifruit during commercial curing. Maps (c-d) represent data for the primary row only including interpolation, while the histograms represent data for both rows (n = 67). 103
- Figure 3.1: (a) Environmental X-sense logger in the curing room, (b) Measuring fruit crate before and after curing, (c) the fruit crate sack before curing, (d) the fruit crates stack has been covered with a layer of shade cloth. 117
- Figure 3.2: Transverse slices of healthy ‘Hayward’ kiwifruit (left) and fruit with SBD symptoms (right)-graininess and progressive water soaked tissue under the skin and the outer pericarp. 119
- Figure 3.3: The environmental conditions profile in and outside of the crates in each simulated curing condition: (a) 10 °C, (b) 20 °C and (c) the ambient conditions before storing fruit at 0 °C. T-CR and RH-CR refer to the environmental temperature and RH profile, respectively at each controlled temperature room and ambient conditions up to 4 days. T-2 d and RH-2 d represent temperature and RH, respectively in each crate in each designed curing condition up to 2 days. T-4 d and RH-4 d represent the temperature and RH profiles, respectively inside each crate under proposed curing condition up to 4 days. 123
- Figure 3.4: Example of healthy ‘Hayward’ kiwifruit (left) and rotten fruit (the side rot) with severe SBD symptoms which had been extended throughout the whole pericarp (right). 133
- Figure 3.5: Comparison of ‘Hayward’ kiwifruit softening during storage for up to 140 d at 0 °C following holding at 8 °C-6 d or 16 °C-4 d and immediately stored fruit at 0 °C. Each value is the mean of 20 fruit (Burdon et al., 2017) with mean fruit firmness at harvest (IMD) and different curing regimes at 10 °C, 20 °C and AMB-4 d during subsequent storage 0 °C in the present experiment. Each value is the mean of fruit firmness of three orchards (n = 3), with 110 fruit per replicate per treatment at 100-125 d and 220 fruit per replicate per treatment at 150-175 d. 138
- Figure 4.1: Expression of cell wall-degrading genes in ‘Sanuki Gold’ kiwifruit stored under room temperature 25 °C or low temperature 4 °C with or without repeated 1-MCP treatments. RT-Cont, stored at 25 °C; RTMCP, stored at 25 °C with repeated 1-MCP treatments; LT-Cont, stored at 4 °C; LT-MCP, stored at 4 °C with repeated 1-MCP treatments. Each sample lane was loaded with 5 lg of total RNA (Mworiora et al., 2012). 148

Figure 4.2: Temperature recorded by the local weather station from 23rd March to 15th May 2016..... 150

Figure 4.3: Temperature recorded by the local weather station from 15th May to 15th June 2016. 150

LIST OF TABLES

Table 2.1: Weight loss (%) of measured fruit on top (a) and in middle (b) of 320 kg ‘Hayward’ kiwifruit in the primary row (n = 72) during commercial curing.	73
Table 2.2: Weight loss (%) of measured fruit on top (a) and in middle (b) of 320 kg ‘Hayward’ kiwifruit in the secondary row (n = 74) during commercial curing.....	74
Table 2.3: Comparison of differences between two typical bin designs in NZ kiwifruit packhouses (Harmandeep, 2010).	110
Table 3.1: Curing regime and assessment times following storage time at 0 °C.	116
Table 3.2: Mean at-harvest fruit firmness and soluble solids content (%). Each value is the mean of 30 fruit per orchard (mean ± standard error (SE), n = 30). Different letters show statistically significant difference between the treatments.	124
Table 3.3: Mean fruit firmness, soluble solids content and fruit weight loss (%) at harvest and after curing treatments. Each value is the mean of 30 fruit per replicate (3 replicates = orchards) (mean ± SE, n = 90). Each fruit weight loss value is mean of fruit weight loss of 12 crates (20 kg each) each treatment. Different letters show statistically significant difference between the treatments.	124
Table 3.4: The relationship between the orchard and fruit firmness (kg _f) immediately after curing and during 175 d of storage (0 °C). Each value represents the mean ± SE of fruit firmness (kg _f) for each orchard at each assessment time, with 30 fruit per treatment at 0 d (immediately after curing) and 110 fruit per treatment at 100 d, 125 d, 125 d + 7 d (20 °C) and 220 fruit per treatment at 150 d, 175 d. Values in a column with the different letters group are significantly different at (p = 0.05).127	127
Table 3.5: Mean fruit firmness (kg _f) at harvest and also the effect of curing regimes on fruit firmness during subsequent storage at 0 °C. Each value is the mean ± SE of fruit firmness of three orchards (n = 3), with 110 fruit per replicate per treatment at 100 d, 125 d, 125 d + 7 d (20 °C) and 220 fruit per replicate per treatment at 150 d, 175 d. Values in a row with the different letters are significantly different at (p = 0.05).	129
Table 3.6: Curing regime treatment influence on SBD incidence (%) during storage at 0 °C. Data represent mean of SBD incidence (%) of three replicate orchards (n = 3), with 110 fruit per replicate per treatment at 100 d, 125 d, 125 d + 7 d (20 °C) and 220 fruit per replicate per treatment at 150 d, 175 d. Mean column/row represents the pooled data from three orchards throughout four storage assessments. Values in a column/row with the different letters are significantly different at (p = 0.05). ..	131

Table 3.7: The relationship between the orchard and SBD incidence (%) during 175 d of storage (0 °C). Each value represents the mean of SBD incidence (%) for each orchard throughout four storage assessment time (125 d to 175 d). Values in a column with the different letters group are significantly different at (p = 0.05). 131

Table 3.8: Effect of curing regimes on rot incidence (%) after subsequent storage at 0 °C. Data represent the mean of rot incidence (%) of three orchards (n = 3), with 110 fruit per replicate per treatment at 100 d, 125 d, 125 d + 7 d (20 °C) and 220 fruit per replicate per treatment at 150 d, 175 d..... 132

LIST OF APPENDICES

Appendix A: Airflow in the designed curing room (10 °C and 20 °C, 2-4 days) and the crates stack's location.....	158
Appendix B: Statistical Analysis	159