

Avocado testing helps lead to improve eating quality for consumers

Julie Petty and Joanna Embry (Avocados Australia)

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Julie Petty and Joanna Embry

Avocados Australia, PO Box 8005 Woolloongabba Queensland 4102 Australia

Consumer sensory testing has shown that 85% of consumers prefer to buy avocados at a level of ripeness between ripe to soft ripe which they can eat that night. Further, internal quality defects of more than 10% impact negatively on future purchase intent. Based on the consumer sensory work the industry standard for maturity (Dry Matter %) for Hass was increased from 21% to 23% at the time of harvesting. Shepard was kept at 21%. Research showed that consumer acceptance of the quality of avocados declined from around 95% to 70% if the Hass Dry Matter is below 23% and that around 70% of consumers would choose 26% Dry Matter avocados over 22% Dry Matter avocados.

In order to benchmark industry's performance against these standards two programs have been put in place. Firstly, monthly fruit quality surveys are conducted in 16 stores each in Perth, Brisbane, Sydney and Melbourne. A random sample of avocados (up to 240) each month are purchased to assess for internal quality blemishes including bruising, internal rots, vascular browning, diffuse flesh colour and stem end rot.

Secondly, random Dry Matter % testing is conducted each month from fruit sampled from the Sydney markets to measure fruit maturity. Up to 220 individual avocados are sampled each month and the aggregated results of these tests are reported on the Avocados Australia website. Results for individual growers or packers are also sent to those businesses.

This information helps industry to build an understanding of its performance against these targets.

Las pruebas de aguacate ayudan a conducir a mejorar la alimentación de calidad para los consumidores

Julie Petty y Joanna Embry

Avocados Australia, PO Box 8005 Woolloongabba Queensland 4102 Australia

Pruebas sensoriales del consumidor ha demostrado que el 85% de los consumidores prefieren comprar los aguacates en un nivel de madurez blando donde se puede consumir el mismo día. Además, defectos de calidad internos han impactado negativamente a más del 10% de los consumidores para compras futuras. Basándose en la labor de los consumidores sensorial del estándar de la industria de la madurez (% de materia seca) para Hass se incrementó de 21% a 23% en el momento de la cosecha. Shepard se mantuvo en 21%. La investigación demostró que la aceptación del consumidor de la calidad de los aguacates se redujo de alrededor del 95% al 70% si el Hass de materia seca es inferior a 23% y que alrededor del 70% de los consumidores elegirían el 26% Materia seca aguacates más de 22% de materia seca.

Con el fin de desempeño de la industria de referencia en contra de estas normas dos programas se han puesto en marcha. En primer lugar, las encuestas mensuales de calidad de la fruta se llevan a cabo en 16 tiendas cada uno en Perth, Brisbane, Sydney y Melbourne. Una muestra al azar de los aguacates (hasta 240) cada mes se compran para evaluar la calidad interna, incluyendo manchas pudre moretones, en la residencia, vascular de color dorado, la carne difusa y la pudrición del tallo final.

En segundo lugar, las pruebas al azar en seco% de materia se lleva a cabo cada mesa base de frutas de muestreo de los mercados de Sydney para medir la madurez del fruto. Hasta 220 aguacates individuales se toman muestras de cada mes y los resultados agregados de estas pruebas se presentan en el sitio web de aguacates Australia. Los resultados para los productores individuales o empacadores también se envían a las empresas. Esta información ayuda a la industria para construir una comprensión de su desempeño en contra de estos objetivos.

Key words: avocado quality dry matter testing benchmark

Notation: NA

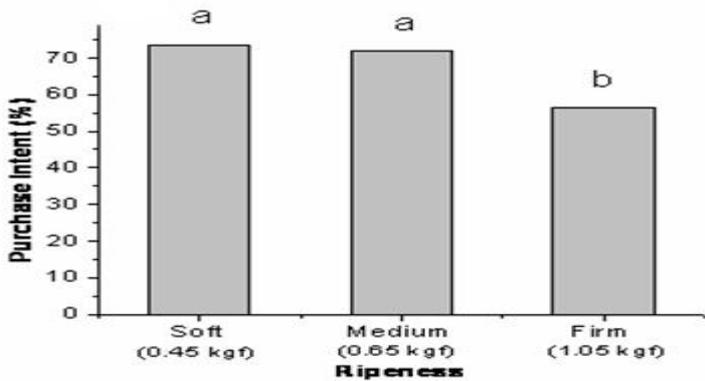
Introduction

Two of the priority areas for investment for the avocado industry over the last six years have been increasing the eating quality of avocados and improving supply chain efficiency. Recognising that the wide variety of factors affecting fruit quality, productivity and supply chain efficiency are interrelated, a Supply Chain Improvement Program was developed in 2009. The aim of the program was to specifically identify where the industry sat in terms of quality and efficiency and identify points in the supply chain where further work is required to make improvements in these areas.

As part of this program, consumer sensory testing was completed to determine quality levels which provide an acceptable consumption experience for consumers and hence do not negatively impact on future purchasing decisions. The results from this work in summary indicated that consumers prefer Hass avocados of maturity equal to or higher than 22% Dry Matter (DM) and there is a competitive advantage to be gained by supplying Hass increasingly along the range from 22% through to 28%. In light of these results the industry endorsed that the DM Standard for Hass had be changed from 21% to 23%.

The results further indicated that 85% of consumers prefer to buy avocados at a level of ripeness that they can consume that evening (which equates to a ripeness level between ripe to soft ripe), see Figure 1. Lastly, consumers indicated that any internal quality defects to more than 10% of the overall flesh at all price points would impact negatively on future purchase intent.

Figure 1: Purchase intent for avocados at different ripeness levels



Given this research, it was clear that the three most important areas driving consumer satisfaction are quality, maturity and ripeness. Two programs were put in place to monitor these drivers in the market place; retail quality surveys and DM testing. Results from these programs are used to benchmark the industry against consumer expectations.

Retail Quality Surveys

Quality surveys are conducted in four capital cities including Sydney, Brisbane, Melbourne and Perth. In each city, 16 stores are surveyed on a monthly basis. 15 pieces of fruit (including both Hass and Shepard when available) are sampled from each store and tested for percentage of overall damage and then proportions attributable to specific types of damage. The ripeness of the fruit is measured

using penetrometers (an invasive tool that measures flesh firmness). The following information is collected about the avocados in the stores:

- The price of the fruit
- Country of origin
- Size of the display
- How the fruit is displayed (stacked or single layer)
- The proportion of different coloured fruit on display

From the 15 pieces of fruit bought for assessment, the following information is collected:

- Stickers on the fruit
- Fruit weight
- Skin colour
- Penetrometer reading
- % total damage
- % bruising
- % diffuse fresh discolouration
- % vascular browning
- % stem end rot
- % body rots
- % other defects

In order to look at how the current level of quality at the retail level matches up with consumer preferences, statistical analysis of this data has been completed by the New Zealand Institute for Plant & Food Research Limited (Plant & Food Research).

The specific research objectives were:

For both total damage and specific defects, statistical analysis was conducted to measure the proportion of fruit that fitted into each of the following intervals analysed, where possible by variety (Hass and Shepard):

- Overall
- By state
- By state by sampling month
- By store type
- By store type by state
- By store type by state by sampling month
- By specific growers (as marked by packhouse identification)
- Where possible, by growing region
- By individual stores

In addition, analysis was conducted to examine how such information related to the different price points at which the fruit were being sold.

Lastly, each of the individual avocados (both Hass and Shepard) were classified into a set of categories according to the severity of overall damage. The categories were "Undamaged" (0% of the individual fruit damaged), "Low" (1-10% damaged), "Moderate" (11-25% damaged), "High" (26-33%), "Very High" (34-50%), and "Extremely High" (greater than 50% of the fruit damaged).

Results for Hass up until June 2010 include:

Overall and State Incidences: of the Hass fruit sampled, 44% had no damage present. Of the 56% of fruit damaged, most were in the lower damage categories, with 32% and 15% in the low and moderate categories respectively. Further analysis showed evidence of a significant interaction between state

and total damage (see Table 1). This interaction seemed to be driven by the fact that Victoria (VIC) had a higher proportion of undamaged fruit compared with the others, while New South Wales (NSW) and Western Australia (WA) had only slightly more than a third of fruit being undamaged and around 10% categorised in the two highest damage bands.

Table 1: Total damage (% incidence) to Hass avocado fruit by state

Total Damage by State						
State	No Damage	1-10%	11-25%	26-33%	34-50%	50%+
N	35.90	35.20	16.40	2.50	5.50	4.50
Q	47.10	30.80	11.50	3.50	2.90	4.20
V	55.00	33.70	10.10	0.30	0.70	0.1
W	38.70	26.80	18.80	4.10	7.50	4.10
Total	43.70	31.80	14.50	2.50	4.30	3.20

Monthly Incidences: there was evidence that Month and Total Damage were not independent. There was a slight trend, with October to December 2009 having higher rates of damaged fruit. Conversely April to June 2010 had less than half being damaged. Within each State, there were also associations between Month and Total Damage for every State except VIC. NSW had higher percentages of undamaged fruit in the April and May months compared with the rest. Queensland (QLD) had higher damage from November 2009 through to February 2010. Monthly incidences of damage for VIC varied from one third to two thirds with no obvious seasonal pattern. WA had a very low proportion of undamaged fruit in December 2009.

Region of Origin Incidences: the Region of Origin also appeared to have a significant association with Total Damage. Regions 4, 8 and 9 had higher rates of damage while regions 1, 2, 5 and 6 had over half of the Hass avocados classified as undamaged. See Table 2 for an outline of the region codes.

Table 2: Growing Regions and Codes

Growing region	Code	Growing region	Code
North Queensland	1	Central NSW	6
Central Queensland	2	Tristate	7
Sunshine Coast	3	Western Australia	8
South Queensland	4	New Zealand	9
Northern NSW	5		

Overall and State Incidences: all defects showed a significant association with the state in which the fruit were bought. Bruising had a higher incidence in NSW (49%) and WA (47%). Body rots were common in NSW (44%) and QLD (39%), while in VIC (1%) the defect was virtually non-existent. Vascular Browning was slightly more common in WA (19%) and NSW (15%), while VIC only had 7%. Stem end rots had a far higher incidence in QLD (33%) than in WA (19%), NSW (13%) and VIC (5%). Diffuse Flesh discoloration was more common in VIC (14%) and QLD (13%) than NSW (11%) and WA (9%). Overall Bruising was the most common defect, and was the case for each state except for NSW, where Body Rots were more prevalent.

Results for Shepard up until June 2010 include:

Monthly Incidences: Shepard was only sampled during the periods from July to August 2009 and January until June 2010 and there was strong evidence that the damage incidences were not constant during this time. While most months were similar, February had a high incidence of undamaged fruit (64%).

Overall and State Incidences: The Shepard avocados sampled had a higher percentage of undamaged fruit (61%) than Hass (44%). This trend was also consistently seen when comparing the two varieties over states, store type and sampling month.

There was an association between the State in which the fruit was purchased and the total damage. NSW had a very high incidence of undamaged fruit (72%), whereas WA and VIC had around 54% of their fruit classified as undamaged.

Table 3: Total damage (% incidence) to Shepard avocado fruit by state

Total Damage by State						
State	No Damage	1-10%	11-25%	26-33%	34-50%	50%+
N	72.20	22.10	4.70	0.30	0.70	0.00
Q	64.00	29.10	5.20	0.60	0.90	0.30
V	54.80	34.30	9.70	0.70	0.30	0.20
W	53.10	33.70	12.20	0.00	1.00	0.00
Total	61.00	30.10	7.60	0.50	0.60	0.50

Store type Incidences: There was no evidence of an association between the type of store in which Shepard avocados were purchased and the damage incidences. For further information on the percentage of defects by month for 2008, 2009 and 2010 please see Appendix 1.

DM Testing

DM surveys are the second tool the Australian avocado industry uses to benchmark its progress in meeting the industry maturity standards for Hass and Shepard. These standards are based off consumer preferences which were determined through consumer testing and research. The minimum DM for Hass is 23% and for Shepard it is 21%.

The DM surveys are conducted monthly with randomly selected fruit collected from the Sydney Wholesale Markets and tested for DM percentage in Maroochydore, Queensland.

The aggregated results of these tests are reported on the Avocados Australia website <http://industry.avocado.org.au/MaturityMonitoring.aspx> and are emailed to all packhouses and wholesalers who contribute to the Infocado system. Infocado is a separate, internet based system which has been developed to assist with the collection of timely, accurate data on the volume of avocados entering the Australian market. Its goal is to assist packhouses, growers and wholesalers in making better informed management and marketing decisions. Individual results are mailed separately to those businesses.

Conclusion and recommendations

Setting goals for quality, maturity and ripeness based off sound consumer research is essential in ensuring that consumption of avocados continues to grow. Measuring industry's progress against set benchmarks is also essential to develop an accurate picture of whether or not quality and maturity are improving in the market place. By gathering the above mentioned data, Avocados Australia is laying a very strong foundation upon which to build an industry leading supply chain improvement program.

Acknowledgments

Avocados Australia would like to acknowledge the individual staff who conduct the monthly retail quality price surveys, the personnel who collect fruit from the Sydney markets for DM testing and the staff at the Maroochy Research station conducting the DM testing.

References

NA

Appendix 1

Table 4: Percentage of various defects in Hass by month during 2008, 2009 and 2010

	Year																							
	2008							2009							2010									
	Bruising							Bruising							Bruising									
	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL			
Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	Row %	N			
1	66.7	22.9	6.9	2.9	0.4	0.1	682	62.6	30.0	4.2	1.1	0.5	1.7	644	72.7	20.6	4.2	0.7	0.6	1.3	545			
2	74.8	18.6	5.4	0.8	0.2	0.2	596	66.3	29.6	3.6	0.0	0.3	0.2	578	73.0	17.0	6.6	2.3	0.5	0.5	393			
3	83.3	10.8	5.4	0.5	0.0	0.0	186	83.2	13.4	3.4	0.0	0.0	0.0	179	*	*	*	*	*	*	0			
4	43.2	37.1	11.3	3.8	2.6	2.0	391	67.2	26.9	5.0	0.5	0.5	0.0	201	69.9	21.7	6.0	1.2	0.0	1.2	83			
5	50.8	33.3	12.4	2.0	0.9	0.6	660	52.5	31.8	8.4	3.6	2.6	1.1	663	73.2	15.8	6.5	2.5	0.2	1.8	557			
6	48.8	36.7	9.9	2.0	0.9	1.6	694	59.6	28.3	7.7	1.8	0.5	2.0	597	75.4	21.0	2.5	0.7	0.0	0.4	715			
7	52.7	33.5	10.3	1.0	1.4	1.1	788	60.7	28.6	7.4	2.1	1.0	0.2	514	73.4	20.3	4.0	1.1	0.3	0.8	621			
8	44.6	37.4	11.8	2.9	0.8	2.5	727	61.9	26.5	9.9	1.1	0.4	0.4	567	72.2	21.2	5.3	0.7	0.4	0.2	1281			
9	50.3	39.5	8.3	1.1	0.3	0.5	736	64.9	26.9	4.6	1.2	1.4	0.9	646	33.3	0.0	66.7	0.0	0.0	0.0	3			
10	57.5	34.6	6.3	0.8	0.2	0.6	630	59.0	28.6	8.4	2.4	0.6	1.0	622	78.2	17.0	4.0	0.3	0.2	0.3	578			
11	47.6	42.2	8.6	0.9	0.1	0.6	699	61.9	32.9	4.5	0.3	0.3	0.0	578	77.5	17.0	3.9	0.6	0.0	1.0	675			
12	56.4	35.7	6.7	0.3	0.6	0.3	669	62.4	25.3	9.8	1.7	0.1	0.7	726	73.2	20.2	3.9	1.5	0.2	1.0	609			
TOTAL	54.7	33.3	8.8	1.6	0.7	0.9	7458	61.9	28.3	6.7	1.5	0.8	0.8	6515	74.1	19.3	4.6	1.1	0.2	0.8	6060			
	<=10%		>10%						<=10%		>10%						<=10%		>10%					
	88.00%		12.00%						90.20%		9.80%						93.40%		6.60%					

	Year																							
	2008							2009							2010									
	Body_Rots							Body_Rots							Body_Rots									
	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL			
Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	Row %	N			
1	58.9	28.4	7.2	3.8	0.9	0.7	682	84.0	12.6	1.4	0.5	0.0	1.6	644	76.0	15.2	4.6	1.8	0.7	1.7	545			
2	76.3	19.1	3.4	0.5	0.5	0.2	596	82.0	15.6	2.2	0.0	0.2	0.0	578	75.8	11.2	6.4	3.6	0.8	2.3	393			
3	71.0	22.0	5.9	1.1	0.0	0.0	186	62.6	24.0	10.6	2.2	0.6	0.0	179	*	*	*	*	*	*	0			
4	77.5	17.9	2.8	1.3	0.5	0.0	391	73.1	22.9	3.0	0.0	1.0	0.0	201	92.8	4.8	1.2	1.2	0.0	0.0	83			
5	81.4	10.9	5.5	2.1	0.0	0.2	660	67.9	23.1	6.5	1.2	0.9	0.5	663	75.8	14.4	4.8	1.3	0.5	3.2	557			
6	79.3	14.8	4.3	1.2	0.3	0.1	694	77.4	12.4	4.9	1.8	1.3	2.2	597	81.0	12.0	3.5	1.5	0.7	1.3	715			
7	86.3	9.4	2.8	0.8	0.3	0.5	788	78.4	13.2	3.9	2.7	0.4	1.4	514	78.3	13.5	3.7	1.1	0.6	2.7	621			
8	83.9	10.6	3.3	0.8	0.0	1.4	727	76.0	14.8	5.8	1.1	0.9	1.4	567	81.4	12.7	3.8	1.1	0.1	1.0	1280			
9	84.5	12.9	1.6	0.7	0.1	0.1	736	76.9	15.3	4.8	0.8	1.2	0.9	646	33.3	33.3	0.0	0.0	0.0	33.3	3			
10	86.2	11.3	2.2	0.2	0.2	0.0	630	72.8	15.1	6.3	3.1	1.0	1.8	622	82.0	12.6	3.5	0.3	0.2	1.4	578			
11	86.6	9.7	3.3	0.3	0.0	0.1	699	76.0	17.6	4.7	1.0	0.5	0.2	578	84.6	9.5	3.6	1.0	0.3	1.0	675			
12	82.2	14.5	2.2	0.4	0.3	0.3	669	70.7	18.8	6.1	1.9	1.0	1.5	727	81.4	11.7	2.5	1.3	0.8	2.3	609			
TOTAL	80.3	14.4	3.6	1.1	0.3	0.3	7458	75.6	16.4	4.8	1.4	0.8	1.1	6516	80.2	12.4	3.8	1.3	0.5	1.7	6059			
	<=10%		>10%						<=10%		>10%						<=10%		>10%					
	94.70%		5.30%						92.00%		8.00%						92.60%		7.40%					

Year																								
2008								2009							2010									
Diffuse_Flesh_Discolouration								Diffuse_Flesh_Discolouration							Diffuse_Flesh_Discolouration									
0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL				
Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	N				
1	93.1	3.2	1.3	0.6	0.7	1.0	682	93.3	4.3	0.6	0.0	0.2	1.6	644	89.0	6.6	0.7	1.3	0.6	1.8	545			
2	90.8	6.9	1.2	0.7	0.3	0.2	595	89.6	8.5	1.4	0.2	0.0	0.3	578	89.3	9.2	0.8	0.5	0.0	0.3	393			
3	91.4	6.5	1.1	1.1	0.0	0.0	186	88.3	10.6	0.0	0.6	0.6	0.0	179	*	*	*	*	*	*	0			
4	93.9	5.1	1.0	0.0	0.0	0.0	391	96.0	3.5	0.5	0.0	0.0	0.0	201	94.0	6.0	0.0	0.0	0.0	0.0	83			
5	92.0	3.6	2.9	0.8	0.3	0.5	660	90.0	7.1	2.4	0.3	0.2	0.0	663	89.6	7.4	0.9	1.3	0.2	0.7	557			
6	86.9	5.5	5.0	1.4	0.4	0.7	694	87.6	9.4	1.5	0.7	0.3	0.5	597	91.9	5.5	0.8	1.0	0.0	0.8	715			
7	87.3	6.0	3.0	1.0	1.0	1.6	788	83.1	12.8	3.1	0.2	0.2	0.6	514	90.2	7.4	1.6	0.3	0.0	0.5	621			
8	91.5	5.4	1.7	0.3	0.1	1.1	727	83.6	10.4	3.5	1.2	0.5	0.7	567	90.2	7.4	1.0	0.5	0.3	0.6	1281			
9	90.4	4.9	3.4	0.8	0.3	0.3	736	89.9	8.2	1.4	0.2	0.0	0.3	646	33.3	0.0	0.0	33.3	0.0	33.3	3			
10	91.9	6.0	1.7	0.2	0.0	0.2	630	91.6	6.6	0.8	0.3	0.2	0.5	622	96.5	2.6	0.5	0.2	0.0	0.2	578			
11	86.8	9.6	2.3	0.7	0.0	0.6	698	87.9	10.1	1.4	0.3	0.3	0.0	577	96.4	1.6	0.7	0.6	0.0	0.6	675			
12	83.1	9.6	4.6	2.2	0.0	0.4	669	89.0	7.9	1.7	0.7	0.1	0.7	726	94.4	2.8	1.0	0.5	0.2	1.1	609			
TOTAL	89.6	6.0	2.6	0.8	0.3	0.6	7456	89.0	8.3	1.7	0.4	0.2	0.5	6514	91.9	5.6	0.9	0.7	0.1	0.7	6060			
	<=10%		>10%						<=10%		>10%						<=10%		>10%					
	95.60%		4.40%						97.30%		2.70%						97.50%		2.50%					
Year																								
2008								2009							2010									
Other_Defects								Other_Defects							Other_Defects									
0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL				
Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	N				
1	99.0	0.9	0.1	0.0	0.0	0.0	682	98.3	1.7	0.0	0.0	0.0	0.0	644	94.7	3.3	1.8	0.2	0.0	0.0	545			
2	93.6	6.4	0.0	0.0	0.0	0.0	596	97.6	2.2	0.2	0.0	0.0	0.0	578	97.5	0.5	2.0	0.0	0.0	0.0	393			
3	93.5	6.5	0.0	0.0	0.0	0.0	186	94.4	2.2	2.8	0.0	0.6	0.0	179	*	*	*	*	*	*	0			
4	99.7	0.3	0.0	0.0	0.0	0.0	391	96.5	3.0	0.0	0.0	0.5	0.0	201	100.0	0.0	0.0	0.0	0.0	0.0	83			
5	99.5	0.5	0.0	0.0	0.0	0.0	660	96.4	1.5	2.0	0.0	0.2	0.0	663	97.1	1.1	0.9	0.2	0.2	0.5	557			
6	99.3	0.7	0.0	0.0	0.0	0.0	694	99.0	0.8	0.2	0.0	0.0	0.0	597	99.7	0.3	0.0	0.0	0.0	0.0	715			
7	98.5	1.5	0.0	0.0	0.0	0.0	788	96.3	3.3	0.4	0.0	0.0	0.0	514	98.2	1.3	0.2	0.0	0.0	0.3	621			
8	99.2	0.7	0.0	0.0	0.0	0.1	727	96.3	2.6	0.7	0.0	0.2	0.2	567	97.7	1.4	0.8	0.1	0.1	0.0	1281			
9	98.5	1.4	0.0	0.0	0.1	0.0	736	97.2	2.2	0.6	0.0	0.0	0.0	646	66.7	0.0	33.3	0.0	0.0	0.0	3			
10	99.2	0.8	0.0	0.0	0.0	0.0	630	95.2	3.7	0.6	0.2	0.2	0.2	622	99.0	1.0	0.0	0.0	0.0	0.0	578			
11	98.6	1.4	0.0	0.0	0.0	0.0	699	96.9	1.6	1.6	0.0	0.0	0.0	578	99.4	0.6	0.0	0.0	0.0	0.0	675			
12	99.0	0.9	0.0	0.0	0.1	0.0	669	97.4	1.0	1.5	0.0	0.1	0.0	727	98.2	1.3	0.3	0.0	0.2	0.0	609			
TOTAL	98.4	1.5	0.0	0.0	0.0	0.0	7458	97.0	2.1	0.8	0.0	0.1	0.0	6516	98.0	1.2	0.6	0.0	0.0	0.1	6060			
	<=10%		>10%						<=10%		>10%						<=10%		>10%					
	99.90%		0.10%						99.00%		1.00%						99.20%		0.80%					

	Year																				
	2008							2009							2010						
	Stem_End_Rot							Stem_End_Rot							Stem_End_Rot						
	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL
Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	N	
1	77.3	18.8	2.6	1.3	0.0	0.0	682	79.2	18.2	1.7	0.2	0.2	0.6	644	78.7	16.9	3.5	0.9	0.0	0.0	545
2	78.0	19.0	2.9	0.2	0.0	0.0	596	75.4	23.4	1.2	0.0	0.0	0.0	578	76.1	17.8	4.6	1.3	0.0	0.3	393
3	86.0	12.4	1.6	0.0	0.0	0.0	186	68.7	20.7	10.6	0.0	0.0	0.0	179	*	*	*	*	*	*	0
4	81.6	15.9	2.0	0.5	0.0	0.0	391	89.1	10.9	0.0	0.0	0.0	0.0	201	83.1	15.7	1.2	0.0	0.0	0.0	83
5	84.2	12.0	3.5	0.3	0.0	0.0	660	86.0	11.3	2.6	0.2	0.0	0.0	663	84.4	11.3	3.2	0.7	0.2	0.2	557
6	86.0	10.7	3.0	0.3	0.0	0.0	694	84.6	11.6	3.7	0.2	0.0	0.0	597	89.9	7.6	2.1	0.3	0.1	0.0	715
7	87.7	10.2	1.6	0.3	0.1	0.1	788	88.3	8.4	3.1	0.2	0.0	0.0	514	84.9	13.2	1.8	0.0	0.0	0.2	621
8	89.4	8.0	1.8	0.1	0.1	0.6	727	91.5	6.7	1.6	0.2	0.0	0.0	567	90.8	8.2	0.9	0.1	0.0	0.0	1281
9	92.7	6.4	1.0	0.0	0.0	0.0	736	91.0	7.9	0.6	0.2	0.3	0.0	646	66.7	0.0	33.3	0.0	0.0	0.0	3
10	88.1	11.1	0.8	0.0	0.0	0.0	630	87.0	11.3	1.0	0.2	0.0	0.6	622	91.7	7.3	0.9	0.0	0.0	0.2	578
11	76.1	21.2	2.6	0.1	0.0	0.0	699	79.6	18.3	1.7	0.3	0.0	0.0	578	88.6	9.2	2.1	0.1	0.0	0.0	675
12	76.5	22.3	0.9	0.1	0.0	0.1	669	71.2	23.6	4.4	0.4	0.0	0.4	726	76.5	20.2	3.3	0.0	0.0	0.0	609
TOTAL	83.7	13.8	2.0	0.3	0.0	0.1	7458	82.9	14.3	2.3	0.2	0.0	0.2	6515	85.7	11.7	2.2	0.3	0.0	0.1	6060
	<=10%		>10%					<=10%		>10%					<=10%		>10%				
	97.60%		2.40%					97.30%		2.70%					97.40%		2.60%				

	Year																				
	2008							2009							2010						
	Vascular_Browning							Vascular_Browning							Vascular_Browning						
	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL
Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	N	
1	71.7	22.0	3.1	2.1	0.3	0.9	682	88.0	10.4	1.1	0.2	0.0	0.3	644	92.5	6.1	1.3	0.2	0.0	0.0	545
2	85.7	9.4	2.3	1.2	0.5	0.8	596	86.3	11.2	2.2	0.2	0.0	0.0	578	77.4	18.3	2.8	1.0	0.0	0.5	393
3	73.7	19.4	3.8	0.5	2.2	0.5	186	76.0	15.1	6.1	1.7	0.6	0.6	179	*	*	*	*	*	*	0
4	84.4	10.2	3.3	1.3	0.3	0.5	391	92.5	6.5	1.0	0.0	0.0	0.0	201	98.8	1.2	0.0	0.0	0.0	0.0	83
5	89.4	5.6	3.9	0.8	0.3	0.0	660	96.4	2.7	0.5	0.3	0.0	0.2	663	92.3	4.5	1.4	0.2	0.2	1.4	557
6	91.1	5.6	2.9	0.4	0.0	0.0	694	91.8	5.2	1.7	0.3	0.2	0.8	597	97.1	2.1	0.8	0.0	0.0	0.0	715
7	84.4	8.9	3.8	1.3	0.8	0.9	788	86.8	9.7	2.5	0.4	0.6	0.0	514	88.2	9.8	1.1	0.8	0.0	0.0	621
8	87.6	6.6	3.0	1.4	0.1	1.2	727	85.4	11.3	2.3	0.5	0.4	0.2	567	93.8	5.5	0.8	0.0	0.0	0.0	1281
9	89.1	7.7	1.5	1.0	0.3	0.4	736	90.1	8.4	1.4	0.2	0.0	0.0	646	100.0	0.0	0.0	0.0	0.0	0.0	3
10	90.0	5.9	3.0	0.8	0.2	0.2	630	88.4	9.2	1.9	0.3	0.0	0.2	622	92.6	5.2	1.2	0.7	0.0	0.3	578
11	81.0	12.3	3.9	1.6	0.7	0.6	699	78.4	18.2	2.4	0.7	0.2	0.2	578	90.5	4.7	3.1	0.9	0.4	0.3	675
12	79.2	13.0	6.1	0.9	0.6	0.1	669	80.2	16.9	2.3	0.4	0.1	0.0	727	89.8	6.1	1.6	0.5	0.2	1.8	609
TOTAL	84.6	10.0	3.4	1.1	0.4	0.5	7458	87.1	10.3	1.9	0.4	0.1	0.2	6516	91.5	6.2	1.4	0.4	0.1	0.4	6060
	<=10%		>10%					<=10%		>10%					<=10%		>10%				
	94.60%		5.40%					97.40%		2.60%					97.70%		2.30%				

Year																					
2008								2009								2010					
Total_Damage								Total_Damage								Total_Damage					
0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	0%	1-10%	11-25%	26-33%	34-50%	50%+	TOTAL	
Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	N	Row %	Row %	Row %	Row %	Row %	Row %	N	
1	32.6	41.2	15.5	2.6	4.0	4.1	682	43.8	41.6	9.3	0.9	2.0	2.3	644	47.7	32.5	11.4	2.6	3.5	2.4	545
2	40.3	36.6	12.9	1.5	6.2	2.5	596	39.1	38.4	17.8	1.0	3.1	0.5	578	41.7	26.7	17.6	4.8	4.8	4.3	393
3	40.3	40.3	11.8	1.1	4.3	2.2	186	38.5	23.5	18.4	3.4	10.6	5.6	179	*	*	*	*	*	*	0
4	31.5	37.3	19.2	2.8	5.6	3.6	391	47.8	37.8	9.0	1.5	3.5	0.5	201	62.7	22.9	10.8	0.0	3.6	0.0	83
5	40.8	25.2	15.8	9.4	6.8	2.1	660	40.9	33.0	12.1	3.3	6.2	4.5	663	50.6	28.4	11.8	1.6	2.0	5.6	557
6	36.2	32.4	17.0	6.3	4.5	3.6	694	43.0	32.2	13.7	2.0	4.4	4.7	597	55.7	32.9	6.6	2.0	1.4	1.5	715
7	38.8	30.2	15.1	2.4	7.9	5.6	788	41.2	33.5	12.5	3.3	6.0	3.5	514	45.7	34.5	12.7	0.0	3.9	3.2	621
8	34.4	31.5	20.8	2.9	6.6	3.9	727	41.6	30.5	16.6	2.5	4.2	4.6	567	47.6	34.0	13.4	0.0	2.7	2.2	1281
9	38.9	40.1	13.3	1.9	4.3	1.5	736	48.3	29.7	13.2	2.0	4.0	2.8	646	33.3	33.3	0.0	0.0	0.0	33.3	3
10	43.3	37.6	12.4	1.6	4.1	1.0	630	39.2	30.7	17.5	2.9	6.3	3.4	622	49.8	35.8	10.7	0.0	1.9	1.7	578
11	31.0	37.9	21.9	2.7	4.4	2.0	699	36.7	37.7	16.6	2.1	4.7	2.2	578	54.5	32.0	9.9	0.0	1.8	1.8	675
12	34.2	36.3	18.7	1.9	7.5	1.3	669	31.4	34.7	21.9	2.5	6.5	3.2	727	41.1	40.7	12.6	0.0	1.3	4.3	609
TOTAL	36.8	35.1	16.4	3.2	5.6	2.8	7458	40.6	34.0	15.1	2.3	4.9	3.2	6516	48.8	33.3	11.7	0.9	2.5	2.8	6060
	<=10%		>10%					<=10%		>10%					<=10%		>10%				
	71.90%		28.10%					74.60%		25.40%					82.10%		17.90%				