

Desordenes fisiológicos en manzanas

Resumen Postcosecha- CP
Sep. 2009



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UNIVERSIDAD DE TALCA

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DAÑO	VARIETADES	Nº de Eventos	Volumen Afectado
Pardeamiento Interno	Fuji	4	6.000 bins aprox.
Daños Epidermales	Granny Smith	2	32 cámaras aprox.
Daños Lenticelares	Fuji	1	n.i.
	Gala	2	n.i.
Escaldado Superficial	Granny Smith	2	n.i.
	Red Delicious	1	n.i.
Sunscald	Granny Smith	1	n.i.
Bitter Pit	Gala	2	n.i.
	Red Delicious	1	n.i.
	Granny Smith	2	n.i.
Partidura Pedicelar (stem-end splitting)	Gala		

n.i.: no identificado



PARDEAMIENTO INTERNO



PARDEAMIENTO INTERNO

- Fuji, Pink Lady, Braeburn
- Generalmente en AC, esporádicamente en FC
- Toxicidad por CO₂
- Pre-cosecha → -Presencia de corazón acuoso



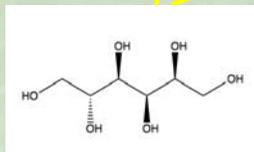
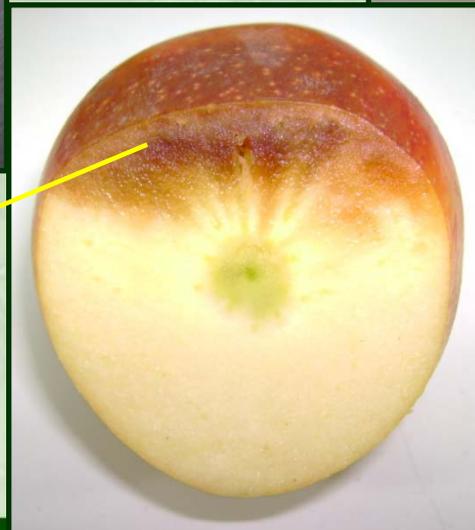
CORAZÓN ACUOSO Y CLIMA CALUROSO



Red Delicious



Braeburn



Sorbitol



PARDEAMIENTO INTERNO

- Pre-cosecha → -Presencia de corazón acuoso, - temperaturas pre-cosecha → densidad celular y espacios intercelulares, y....otros (antioxidantes, ATP ???), -madurez (avanzada...)
- Futuras áreas por investigar : PREDICCIÓN de incidencia con antecedente de precosecha y durante la postcosecha (etanol y fluorescencia, tasa respiratoria...)
- Prevención: Venta rápida (↑ corazón acuoso), <1% CO₂, DPA (antioxidante), retraso entrada AC, >T° guarda (3°C en vez de 1°C).....



DAÑOS EPIDERMALES

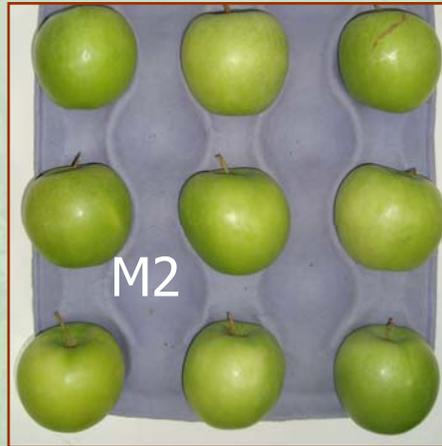


DAÑOS EPIDERMALES

- Factores de pre- y post- cosecha involucrados aún en estudio
- Escaldado superficial descartado
- Condición climática temporada 2008-2009 → 1-MCP postcosecha ??
(metabolismo ceras, sistemas de defensa, membranas, etc..) → síntomas epidermales de pardeado (PPO+fenoles)



DAÑOS EPIDERMIALES



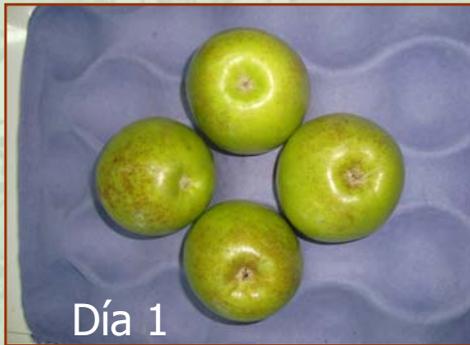
Muestra	Tratamiento	α -farneseno	AO	TC258	TC269	TC281
M1	Con Daño	6.99	97.50	2.01	2.27	0.90
M2	Sin Daño	7.23	82.64	1.65	2.33	1.13

Nota: α -farneseno, Trienos Conjugados (TC258, TC269 y TC281) valores expresados en nmol/cm², Capacidad antioxidante Total (AO) expresada en OD*1000.

Fuente: Centro de Pomáceas.



ESCALDADO SUPERFICIAL



Compuestos relacionados con escaldado en manzanas R. Delicious

Tratamiento	α -farneseno	AO	TC258	TC269	TC281
Sana	17.15	109.17	1.95	1.76	0.81
Daño	53.79	71.25	10.69	16.44	11.74

Nota: α -farneseno, Trienos Conjugados (TC258, TC269 y TC281) valores expresados en nmol/cm², Capacidad antioxidante Total (AO) expresada en OD*1000.

Fuente: Centro de Pomáceas.



SUNSCALD



Fruta con daño

Fruta sana



Tratamiento	Repetición	α -farneseno	AO	TC258	TC269	TC281
Sana	1	51.94	69.00	0.17	0.67	0.63
	2	59.91	81.00	-0.20	0.57	0.72
	3	71.34	86.00	-0.05	0.63	0.70
Promedio		61.06	78.67	-0.03	0.62	0.68
Daño	1	60.34	66.75	1.03	1.02	0.57
	2	77.59	81.00	-0.17	0.54	0.67
	3	48.28	56.50	0.72	1.14	0.58
Promedio		62.07	68.08	0.53	0.90	0.61

Nota: α -farneseno, Trienos Conjugados (TC258, TC269 y TC281) valores expresados en nmol/cm², Capacidad antioxidante Total (AO) expresada en OD*1000.

Fuente: Centro de Pomáceas.



Escaldado Superficial vs Sunscald

- Sunscald=escaldado por sol, directamente relacionado con daño por sol o lado expuesto de la fruta
- No se previene con DPA
- Aparece después de 2-3 meses de almacenaje
- No existe control disponible, a no ser la segregación de fruta con daño por sol levemente visible a cosecha, para venta inmediata
- Efecto de protectores solares usados en pre-cosecha (Surround, Raynox®, Eclipse), sobre sunscald aún no ha sido evaluado....



BITTER PIT



Valores óptimos
(mg/100 g peso fresco)

Ca: 5,5

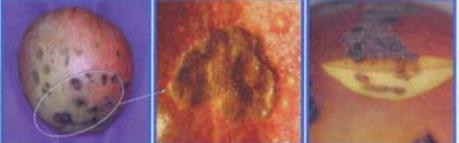
N/Ca: < 10

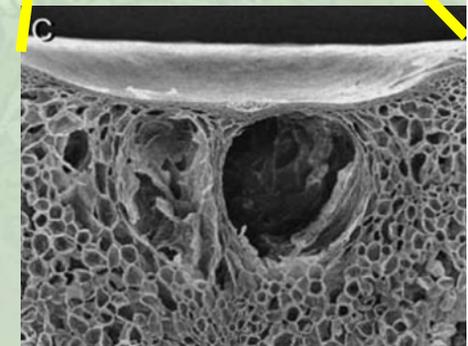
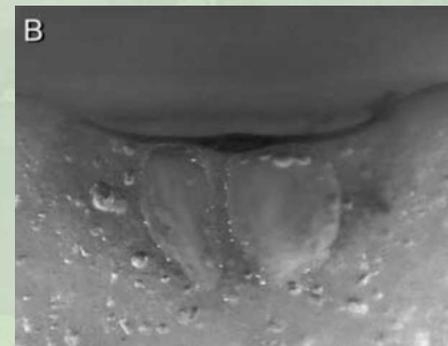
K/Ca: < 30

DAÑOS LENTICELARES

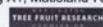
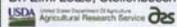


TIPOS DE DAÑOS LENTICELARES/LENTICELOSIS

DESCRIPTION	LENTICEL RELATED DISORDERS	NOTE
<p>Lenticel Breakdown Generally, round pitting centered on a lenticel. Often occurs on less exposed sides or color margins. Early symptoms are like small dimples, visible in angled light. As flesh firmness decreases, pits usually grow in depth and diameter and may coalesce. Flesh is not deeply affected. There may be a cavity beneath the pit.</p>	 <p style="text-align: center;">PROGRESSION →</p>	<p>Fruit tested for LB, should be cold: 1) Briefly rinse fruit in clean cold water; 2) Dip cold fruit in warm water (~90°F) for 5-10 minutes; 3) Wax fruit by hand using a clean soft cloth. Wax film does not need to be thick, but it should cover thoroughly; 4) Place fruit in the cold room for 24 h. *This test may over-express symptoms.*</p>
<p>Blotch Pit Often hard, asymmetric brown patches near the calyx or on exposed side. Flesh browning is deeper, like bitter pit or "Jonathan Spot".</p>		<p>Flesh browning will likely increase and deepen after harvest similar to bitter pit. Hastening ripening will force symptoms.</p>
<p>Heat Injury Lenticels are brown or black, and cracked. Usually visible at harvest. Usually only skin deep.</p>		<p>Does not progress much beyond what is visible at harvest. Occasionally worsens in storage.</p>
<p>Blister Spot Affected lenticels are round and may be raised slightly. Early, may look like pink measles; later may also have a crusty cap.</p>		<p>May progress during storage, but develops very slowly (months).</p>
<p>Calcium Burn Lesions are superficial and localized. Affected lenticels are dark brown to black. Often visible at harvest.</p>		<p>Associated with foliar and drench calcium applications; Repeated foliar applications may increase severity. Does not progress during storage.</p>



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LENTICEL BREAKDOWN/PUDRACION LENTICELAR

- > Gala, Fuji
- Huerto-específico
- Temporada
- Aparece en postcosecha, mayoritariamente después del proceso

- >guarda > incidencia

- > susceptibilidad con: presizing, sobredosificación de químicos en el estanque de vaciado → < tiempo hasta embalaje final < incidencia y severidad



LENTICEL BREAKDOWN/PUDRACION LENTICELAR

- > susceptibilidad: T° fruta vs T° estanque vaciado, detergentes ácidos y neutros
- Manejo y control de los aspectos anteriores NO eliminan el problema
- CAUSA: Factores de Pre-cosecha que aún se siguen estudiando → Nutrición, madurez (+madura, +LB), aplicaciones de huerto, micro-clima → presión de desecación lenticelar



LENTICEL BREAKDOWN/PUDRICION LENTICELAR

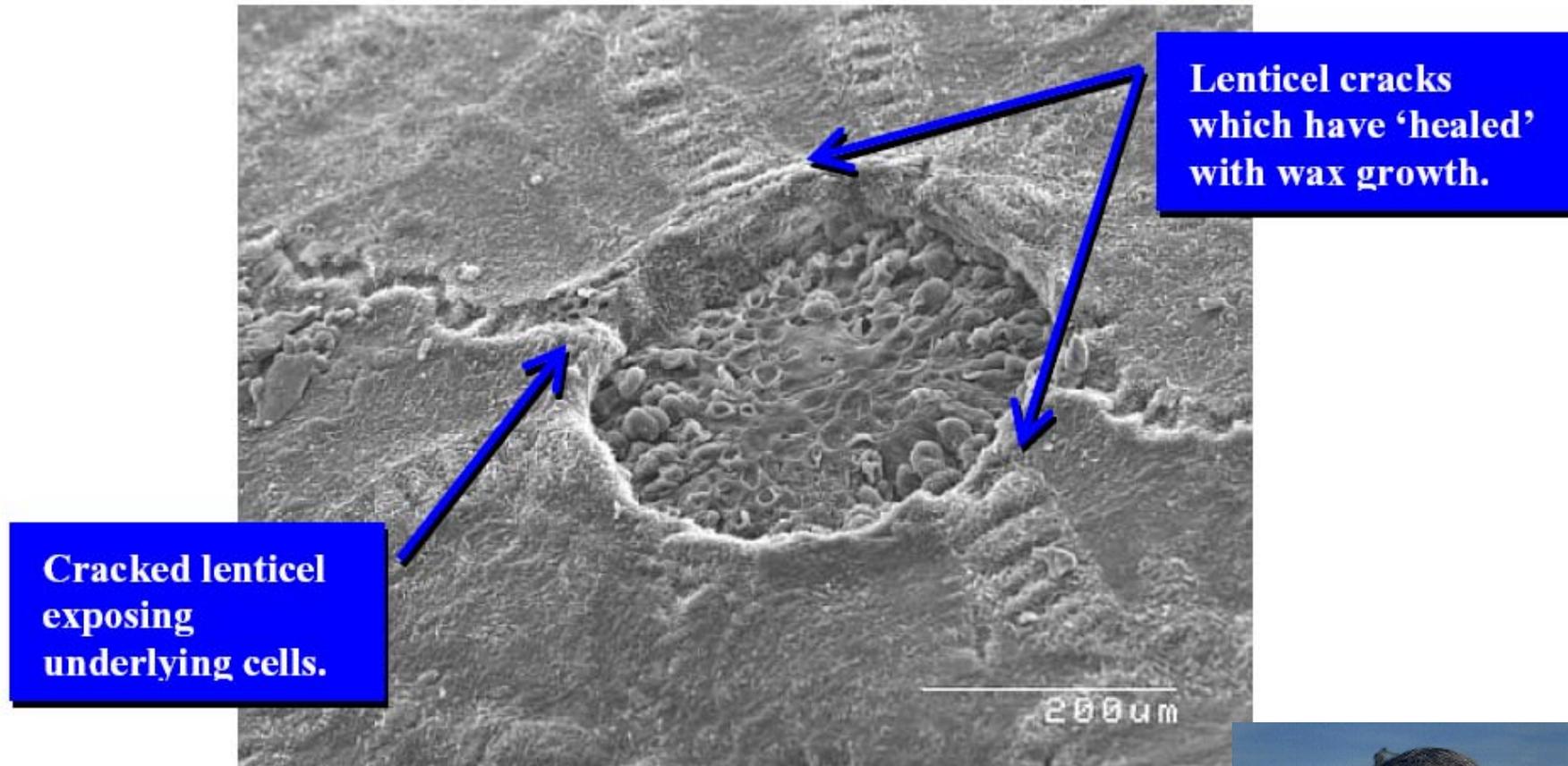
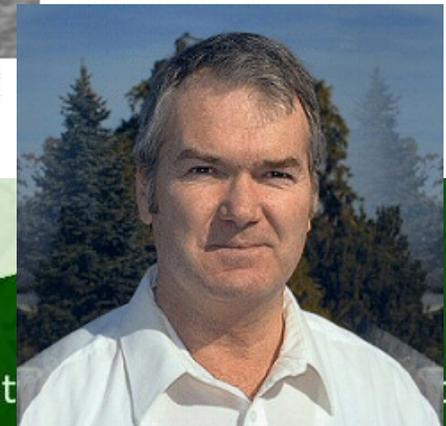


Figure 5. Fruit lenticel with cracks in the cuticle annulus at various stages of 'healing' or 'curing'.

Dr. Eric Curry 2001-
<http://postharvest.tfrec.wsu.edu>

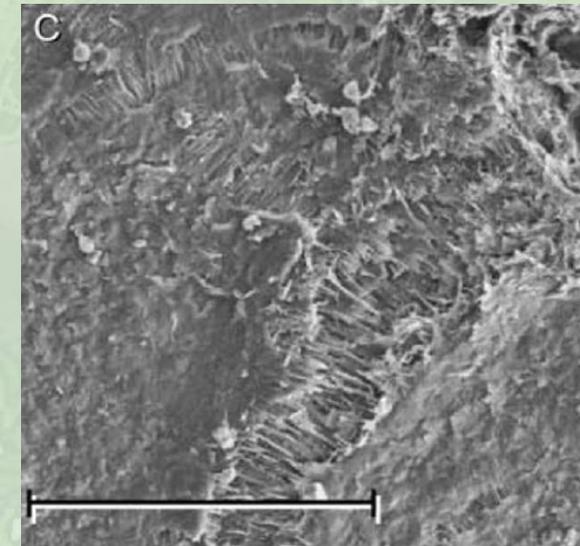
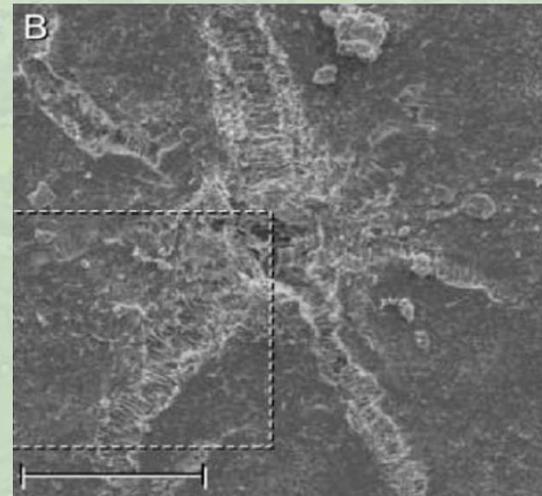
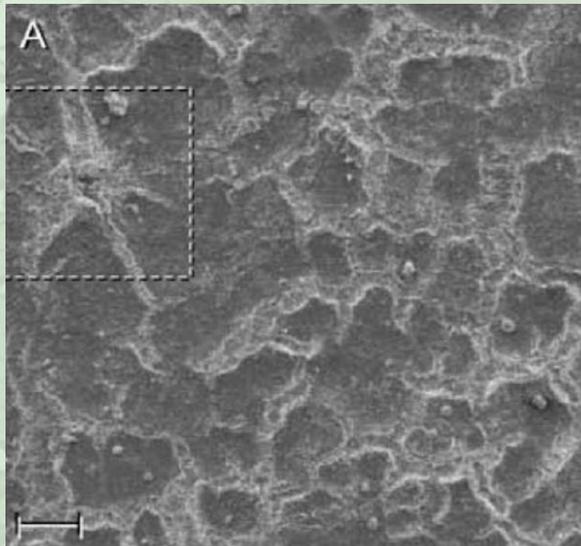


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LENTICEL BREAKDOWN/PUDRACION LENTICELAR



**Preharvest Lipophilic Coatings Reduce
Lenticel Breakdown Disorder in 'Gala' Apples**

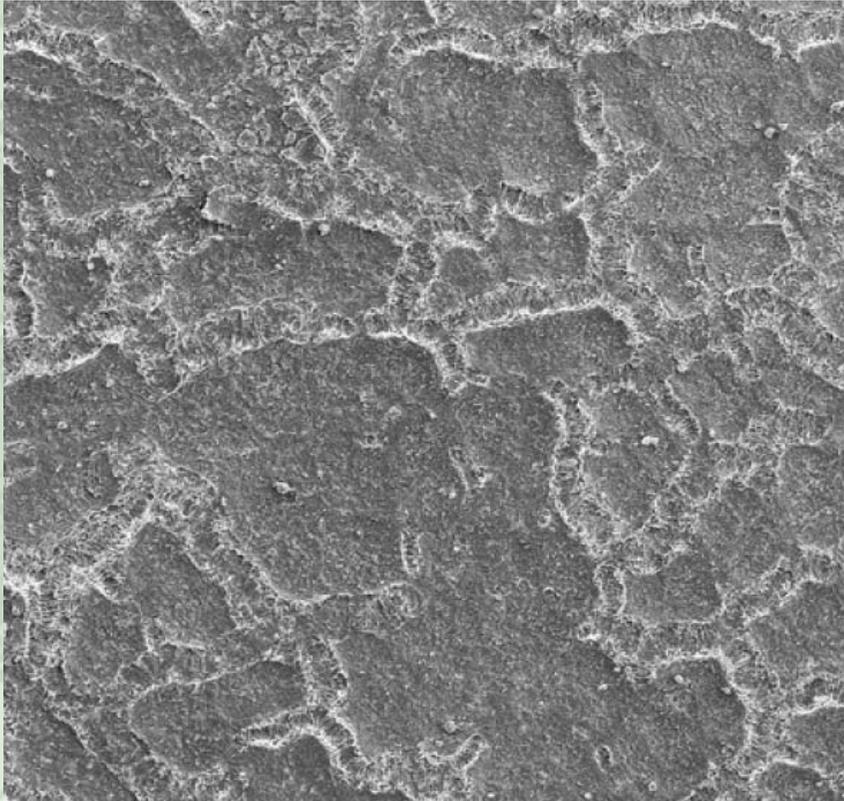
Eric A. Curry^{1,4}, Carolina Torres², and Luis Neubauer³



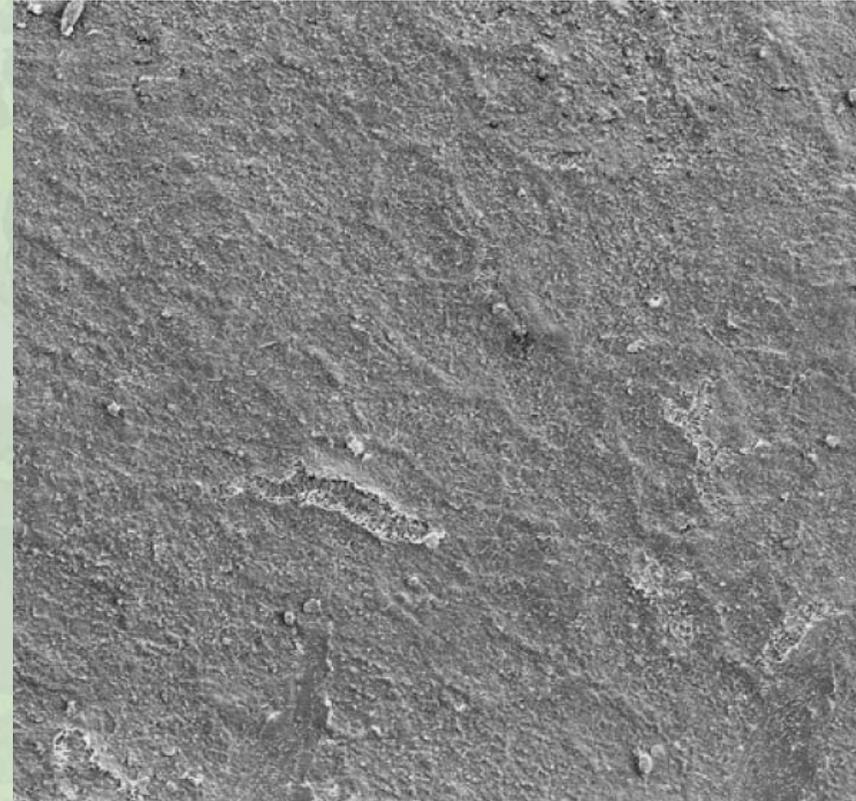
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LENTICEL BREAKDOWN/PUDRIFICION LENTICELAR



Control



Tratado con recubrimiento
pre-cosecha



LENTICEL BREAKDOWN/PUDRACION LENTICELAR

Table 2. Effect of treatment and number of applications of proprietary lipid formulations applied in 2006 to whole 'Gala Gala'/'M.106' apple trees in Malaga, WA, on apple fruit quality and incidence of lenticel breakdown (LB) after 90 or 180 d of storage at $-1\text{ }^{\circ}\text{C}$ ($30.2\text{ }^{\circ}\text{F}$). Treatments were applied using a low-pressure handgun. Multiple applications were applied weekly beginning 3 weeks before harvest (17 Aug.), whereas the single application was applied 1 week before harvest (31 Aug.).

Treatment ^z	Time in RA (d) ^y	Applications (no.)	IEC ($\mu\text{L}\cdot\text{L}^{-1}$) ^x	Fruit firmness (lbf) ^w	Soluble solids (%)	LB incidence (%)
Control	90	—	24.1 d ^v	15.6 a	13.2 a	16.7 a
2.5% EpiShield TM		1	37.9 cd	15.4 ab	13.1 a	12.5 a ^z
1.5% PrimaFresh [®] 50-V			59.0 c	15.1 b	13.0 a	10.8 ab
5.0% Natural Shine TM 9000			39.6 cd	15.0 bc	12.6 b	4.6 b
2.5% EpiShield TM		3	85.0 b	14.4 d	13.1 a	5.0 b
1.5% PrimaFresh [®] 50-V			64.7 bc	14.7 cd	13.4 a	3.3 b
5.0% Natural Shine TM 9000			122.4 a	14.3 d	13.0 a	5.0 b
Control	180	—	157.7 c	13.1 a	12.7 ab	19.2 ab
2.5% EpiShield TM		1	144.8 c	13.1 a	12.8 a	14.2 ab
1.5% PrimaFresh [®] 50-V			162.0 c	13.0 ab	12.5 ab	9.6 b
5.0% Natural Shine TM 9000			271.7 a	12.8 ab	12.3 b	14.2 ab
2.5% EpiShield TM		3	269.5 a	12.6 bc	12.3 b	10.8 b
1.5% PrimaFresh [®] 50-V			228.0 b	12.2 c	12.5 ab	11.2 b
5.0% Natural Shine TM 9000			297.9 a	12.6 bc	12.4 ab	6.7 b

^zEpiShieldTM, PrimaFresh[®] 50-V, and Natural ShineTM 9000 are products of Pace International (Seattle, WA).

^yRA = regular atmosphere storage.

^xIEC = internal ethylene concentration; $1\ \mu\text{L}\cdot\text{L}^{-1} = 1.0\ \text{ppm}$.

^w1 lbf = 4.4482 N.

^vValues within a column with the same letter are not significantly different at $P \leq 0.05$ using Tukey's Studentized range test (HSD) for normally distributed data (IEC, fruit firmness, and soluble solids) or the Kruskal-Wallis test for nonparametric distribution (LB incidence).

Source: Curry, Torres, Neubauer, 2008

Source: Curry et al. 2008



LENTICEL BREAKDOWN/PUDRACION LENTICELAR

Table 3. Effect of treatment and number of applications of proprietary lipid formulations applied in Linares, Chile, in 2007 on expression of lenticel breakdown (LB) in 'Royal Gala' apples after 90 d of storage at $-1\text{ }^{\circ}\text{C}$ ($30.2\text{ }^{\circ}\text{F}$). Treatments were applied using a commercial airblast sprayer at a volume of about $1900\text{ L}\cdot\text{ha}^{-1}$ (203.1 gal/acre). Multiple applications were applied weekly beginning 4 weeks before harvest (23 Jan.). The single application was applied 1 week before harvest (13 Feb.).

Treatment ^z	Applications (no.)	Mean LB incidence (%)
Control	—	12.2 a ^y
2.5% EpiShield TM	1	6.2 b
1.5% PrimaFresh [®] 50-V		10.0 a
5.0% Natural Shine TM 9000		11.2 a
2.5% EpiShield TM	4	06.2 b
1.5% PrimaFresh [®] 50-V		07.5 b
5.0% Natural Shine TM 9000		05.8 b

^zEpiShieldTM, PrimaFresh[®] 50-V, and Natural ShineTM 9000 are all products of Pace International (Seattle, WA).
^yValues within a column with the same letter are not significantly different at $P \leq 0.05$ using the Kruskal-Wallis test for nonparametric distribution.

Source: Curry, Torres, Neubauer, 2008



CONCLUSIONES

- Ingrediente activo o combinación de lípidos es crítico para la efectividad del recubrimiento
- Programa de aplicaciones mejor que aplicación individual
- Disminución parcial del desorden, indicando que existen otros factores involucrados
- Efectos sobre madurez a cosecha y postcosecha son dosis-dependiente.

