


Understanding Citrus Packaging
During Distribution


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Developing a packaging solution
for fresh citrus requires:

Understanding packaging design
Handling conditions
Environmental conditions





Understanding packaging
design:

Materials
Types of handling
One-time use or reusable




Materials

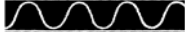

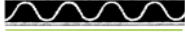

Corrugated
Plastics (PE, PP)


Corrugated

- Over 90% of all shipping containers are corrugated boxes
- Most boxes are specified based on carrier minimum rules (handling durability)
- Carriers permit boxes to carry up to 50 times their own weight and 15 ft high stacked load



FLUTE SIZES		# flutes/ft	Height
	A	36 +/- 3	3/16 inch
	B	50 +/- 3	3/32 inch
	C	42 +/- 3	9/64 inch
	E	90 +/- 3	1/16 inch

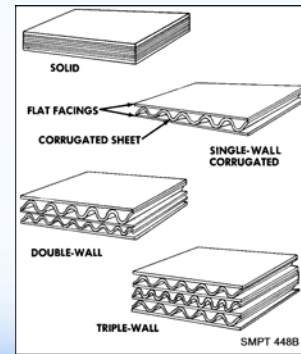
SMPT 767A



Corrugated

Characteristic	A-Flute*	B-Flute	C-Flute	E-Flute
Stack strength	best*	fair	good	poor
Printing	poor	good	fair	best
Die cutting	poor	good	fair	best
Puncture	good	fair	best	poor
Storage space	most	good	fair	least
Score/bend	poor	good	fair	best
Cushioning	best	fair	good	poor
Flat crush	poor	good	fair	fair

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Environmental Stacking Factors

	Compression Loss	Multipliers
Storage time under load	10 days-37 percent loss	0.63
	30 days-40 percent loss	0.6
	90 days-45 percent loss	0.55
	180 days-50 percent loss	0.5
Relative humidity, under load (cyclical RH variation further increase compressive loss)	50 days-0 percent loss	1
	60 days-10 percent loss	0.9
	70 days-20 percent loss	0.8
	80 days-32 percent loss	0.68
	90 days-52 percent loss	0.48
	100 days-85 percent loss	0.15

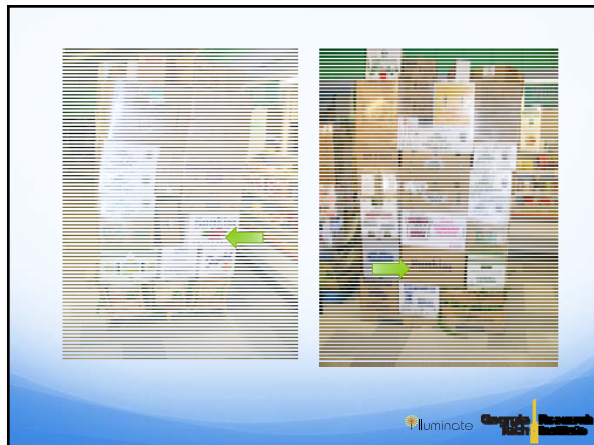
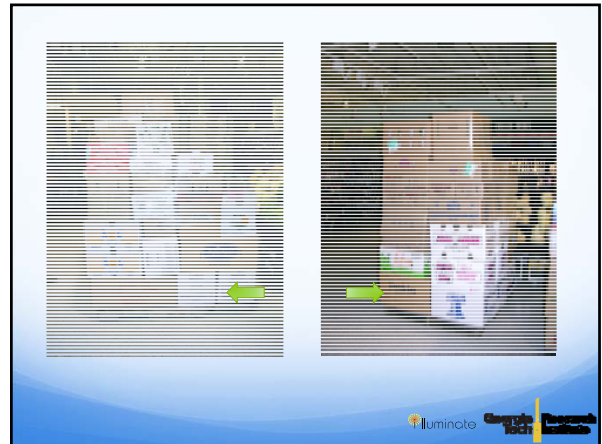
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Environmental Stacking Factors

Pallet Patterns		Best Case	Worst Case
Columnar, aligned	Negligible loss		
Columnar, misaligned	10-15 percent loss	0.9	0.85
Interlocked	40-60 percent loss	0.6	0.4
Overhang	20-40 percent loss	0.8	0.6
Overhang	10-25 percent loss	0.9	0.75
Excessive handling	10-40 percent loss	0.9	0.6

	Type	Multipliers
Transportation (ground)	Truck more than 1,000 miles	0.14
	Truck 100 - 1,000 miles	0.17
	Truck less than 100 miles	0.20
	Rail	0.17
Transportation	Sea Container (rail)	0.20
	Sea	0.1
	Air (cargo)	0.20
	Air (passenger)	0.17
	Parcel (domestic)	0.17
Parcel (international)	0.14	

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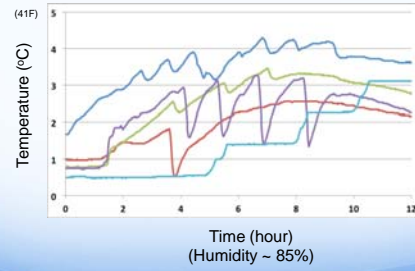


Reusable Plastic Container (RPC)



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Ventilation (Distribution Center to Retail)



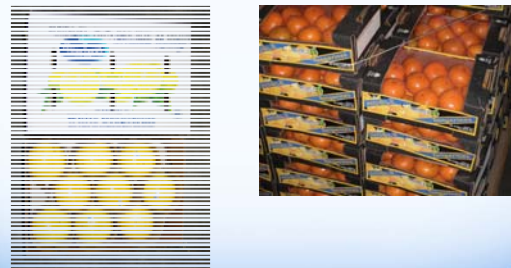
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Ventilation



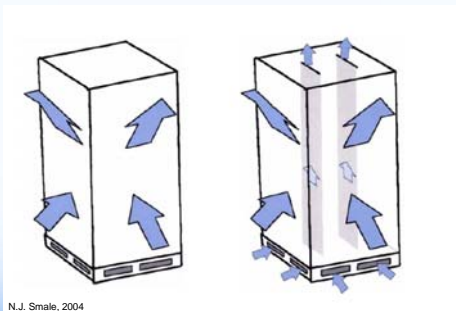
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Ventilation



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Ventilation



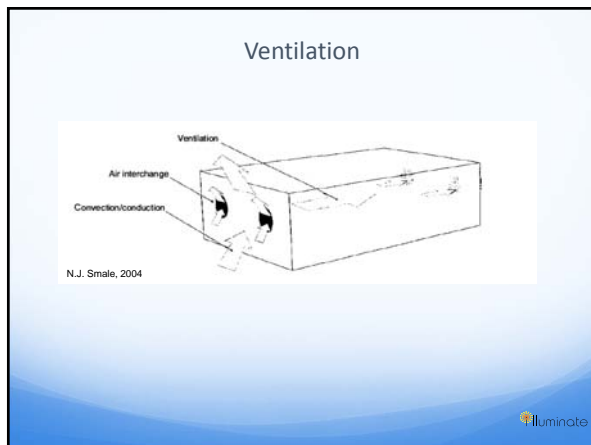
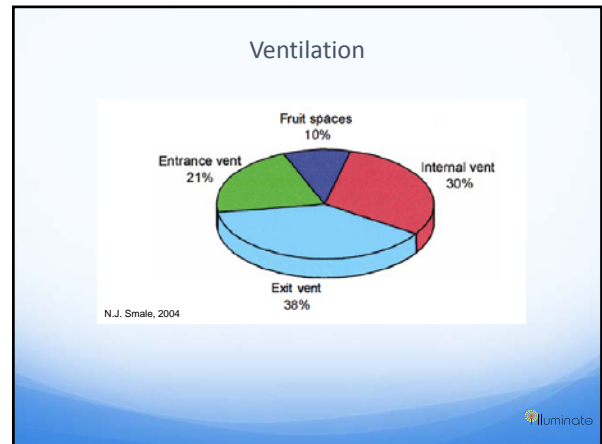
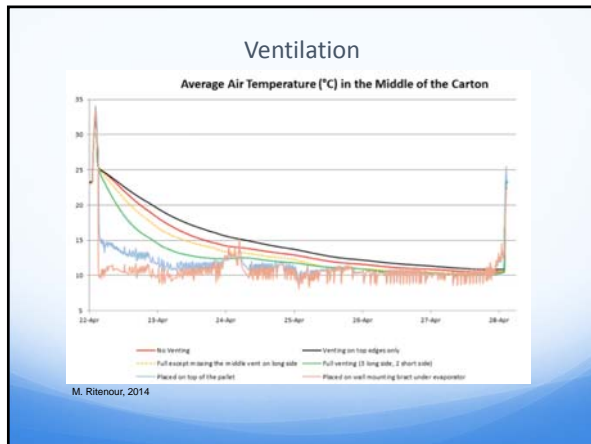
N.J. Smale, 2004

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Ventilation



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- ### Conclusion
- Understanding handling and environmental conditions is essential
 - Most damage occurs between DC and retail stores
 - Ventilation is important and can be achieved by adequate locations of the vents
 - Vent locations should be away from compression points on other boxes

Thank you!

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