III International Conference on Fresh-cut Produce
Packaging Fresh-cut Products
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Presented by:
The JSB Group, LLC

What is Fresh-cut Packaging?
What do you want out of your fresh-cut packaging?

Consider the Possibilities:
A functional, technology, marketing, branding and sustainability platform
- Functional Protection
  • Keeps what’s in and what’s out out
- Technology Platform
  • MAP
- Shelf Life Extension
- Quality Optimization
- Food safety
- Marketing Tool
  • Branding
- Sustainability Tool

What must be considered when designing a fresh-cut package
- Consumer Requirements
- Produce Innovation
- Packaging Technologies
- Marketing
  • Branding
  • Recognition
- Truths

Consumer Requirements
- Safety
- Convenience
- Freshness
- Quality
- Sustainability
- Localvores
- Economics

The Future is Now...
Or is it…..

- Lets not get ahead of ourselves
- ...Only the foolish build their homes on sand…..
- Modified Atmosphere Packaging Fundamentals

Packaging Technologies

Produce Physiology Requirements
Polymer Engineering
Converting/Filling Machine Requirements
Marketing Requirements
  - Branding
  - Story
  - Sustainability

MAP

Jeff’s Fundamental Truth

- Anytime you place fresh-cut produce into a sealed package you have created Modified Atmosphere Package.
- It may not be correct or desired and certainly not optimized; but make no mistake it is a Modified Atmosphere Package.
- This then begs the question; how do I optimize the package...

Packaging Calculations

\[
\text{OTR} = RR \times t \times \frac{W}{A} \times (O_{2\text{atm}} - O_{2\text{pkg}})
\]

Where:
- \(O_{2\text{atm}}\) = Film \(O_2\) Permeability (Oxygen Transmission Rate) per mil
- \(RR\) = Respiration Rate (\(O_2\) Consumption)
- \(t\) = Film Thickness (mils)
- \(W\) = Product Weight (Kg)
- \(A\) = Film Surface Area (cm²)
- \(O_{2\text{pkg}}\) = Desired \(O_2\) Concentration in the Package (\(O_2\) Target Atmosphere)

The calculated OTR is the per mil transmission rate for the given thickness of film used in the calculation.
In other words if you plug in 2 mils the resulting OTR is the per mil transmission rate of that 2mil film.

*To convert OTR (CC/mil/cm²/Hr) to OTR (cc/100 in²/day) multiply by 15483.84

Produce Physiology

Desired atmosphere in the package (O₂ pk)
- Information available from CA/MA literature
- Need to consider oxygen and carbon dioxide tolerances
- Calculations are much more complicated with mixed products in the bag
- Atmospheres in the package should be measured during shelf life
- Avoid anaerobic respiration i.e. when \(O_2\) becomes so low that fermentation occurs and ethanol and acetaldehyde form
  - Flavour
  - Shelf-life (damages membranes)
  - Appearance
Gas flushing
- Rapid drop in O₂ is critical for some products to prevent browning e.g. iceberg lettuce
- Usually flush with nitrogen until 2-8% O₂ remains

Packaging Technologies
- Produce Physiology Requirements
- Polymer Engineering
- Converting/Filling Machine Requirements
- Marketing Requirements
  - Branding
  - Story
  - Sustainability

Polymers Outer Layers
- Each polymer has its own set of gas transmission properties
- Gas moves through each layer of a multilayer package one at a time
- Inks, adhesives, and even antifog coatings must be viewed as a discrete layer
- Typical outer layers of a multiply lamination:
  - PET
  - APET
  - CPET
  - RPET
  - PP
  - OPS
  - PVC
  - PLA
  - K-Resin
  - BON

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Antifog Requirements/ Properties
- Coated/Registered
- Impregnated
- OTR Performance
- Impacts Sealing Properties
- Microwaveable
  - Functional
  - Regulatory
Microwave Requirements/Properties

- **Applicable CFR's**
  Although there is no specific code, which applies Microwave applications, the following CFR's may be applicable when dealing with Antifog's in Microwave Applications:
  - 21CFR Chapter 1 177.1520
  - 21CFR Chapter 1 177.1350
  - 21CFR Chapter 1 177.1390
  - 21CFR Chapter 1 177.1395

- **Structure, Antifog Additives**
  - Are the polymers and additives used to construct the package approved for the temps that the package will reach in the microwave.

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Packaging Technologies

- **Convert/Filling Machine Requirements**
  - Marketing Requirements
  - Branding
  - Story
  - Sustainability

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Converting Requirements

- Dimensions
- Construction Type
- Seal Type
- Graphics
- Stiffness
- Desired OTR
- COF
- Beta Value
- Antifog Requirements
- Re-seal Requirements
- Microwave Requirements
- Cook-In
- Regulatory

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Filling Machine Requirements

- Seal Type
- Filling Speed
- Sealing Conditions
- Differential COF
- Heat Resistance
- Differential
- Re-seal Attachment
- Antifog

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Vertical form fill & seal (VFFS)

- Film is mounted around a tube
- Seals at the back with a lap or fin seal usually
- Rapid
- Adaptable to a wide range of films
- Works well for foods that can fall e.g. chopped lettuce

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Seal type for pillow packs

- Fin Seal
  - inside surfaces of the film meet and seal against themselves.
- Lap Seal
  - inside surface of the film seals to the opposite or outer surface of the film.
Attachments

Zipper can be placed on roll-stock, resulting in more flexibility during manufacturing, or can be automatically applied at forming of the bag.

Horizontal form fill & seal (HFFS)

- Uses one film that is folded on itself
- Filled with product
- Sealed at back, front or both ends
- Fast and economical

Horizontal form fill & seal (HFFS)

- Uses one film that is folded on itself
- Filled with product from top
- Sealed at back, front

Stand-Up Pouches

- Allows product to be displayed upright and free-standing
- Good use of shelf space
- Good protection from mechanical damage
- Use stiffer polymers which tend to have lower OTR
- Micro- & macroperforations

Rigid containers

- Clamshells
- Two piece containers
- Trays
- Rigid Containers

Atmospheres

- Natural Aspiration
- Peelable Lidding
- “Breathable Rigid Containers”
- Patch Technology
**Perforated films**

**Macroperforated**
- Holes visible to the naked eye
- Reduce water loss without modifying O₂ and CO₂
- Prevents produce from going anaerobic

**Microperforated**
- Holes of 40-200 um; not visible to the naked eye
- Usually made by laser
- Useful for products with a high respiration rate
- Tends to be a low to moderate O₂ with a moderate to high CO₂, i.e. cannot have low O₂ and low CO₂
- High RH

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**Jeff’s Corollary Packaging Truths**

- Temperature Control
- Cold Chain Management
- Incoming Product Quality
- Post-harvest Technology
- Leakers
- Gas Flushing
- Static Environment
- One Product Fits All
- Choosing the packaging the week before launch guarantees a non-optimized package

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**Food Safety**

- The CDC in the US summarizes that each year, 1 in 6 Americans get sick from and 3,000 die of foodborne diseases. Reducing foodborne illness by 10% would keep 5 million Americans from getting sick each year. Preventing a single fatal case of E. coli O157 infection would save an estimated $7 million.

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**Active Packaging**

**New Possibilities with Smarter Materials**

1. **Cover Material – Food Contact Side is non-Permeable**
2. **Cover Material – Bottom Side is porous to moisture**
3. **Core Structure**
4. **Active Components**
   - **Superabsorbent**
5. **Core-Surface**
6. **Active Surface**
7. **Non-Absorbent Layer**
   - Polyethylene coat layer:
     a. Does not absorb essential food oils;
     b. Provides wet strength when soaked.
8. **Wicking**
   - White kraft paper layer, wicks away surface moisture from food.
9. **Airflow**
   - Surface texture provides breathing.

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**Antimicrobial Packaging**

**Microbeguard**

1. **Active Surface**
2. **Non-Absorbent Layer**
3. **Wicking**
4. **Airflow**
   - Surface texture provides breathing.
BreatheWay Provides

- Very High Permeability
- Adjustable CO2/O2 Ratio
- Moderate Temperature Compensation
- Improved Quality and Shelf Life

Gateway for Optimal Atmosphere Control

Increased Water Vapor Transmission Rate Films

High WVTR can reduce condensation and, therefore, decay

Peelable Resealable MAP Systems

What is sustainability

Sustainable Packaging Technology

Polymers
Plastics are:
- durable,
- lightweight,
- versatile

Therefore they can help reduce waste and consume less energy.

Lighter packaging = lighter loads = fewer trucks and railcars needed to ship the same amount of product.

This helps to:
- reduce transportation energy,
- decrease emissions
- and lower shipping costs.

For example, just 1 kg of plastic can deliver 30 liters of a beverage.

Sustainable Packaging... the ‘-abilities’

- Recyclable
- Renewable
- Compostable
- Industrial
- Consumer
- Degradable
- Oxy
- Bio
- Land Fills

http://plastics.americanchemistry.com/Sustainability-Recycling
Sustainable Packaging Technology

“Green Polymers”
Nature & More first to market with new sugar cane packaging
- looks like fine cardboard
- easily compostable,
- 100% GMO free!
- made of waste material,
- tree-friendly
- plastic-free,
And the market is embracing this new development.

Sustainable MAP Films
- What sets this product apart from what is currently available is that it will be a fully compostable (both home and industrial composter) in combination with being able to engineer the gas transmission rate of the film structure.
- It will also be biodegradable
- This allows MAP to truly enter into the world of sustainable packaging

Packaging of Fresh-cut Produce
- Optimally designed packaging plays a critical role
- The fundamentals must be covered
- At the end of the day what are the customer requirements and what creative technologies can be brought to bear to address those requirements
- We supply a technical support service that happens to include packaging
- Packaging must be an integral part of the entire new product development process
- The technology and supply of packaging is a global effort in a global market

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