Harnessing New Technology for Sustainable Food Supply - ASEAN and Indonesia Perspectives

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SOY INSIGHT
13th SE Asia Soy Food Symposium
Science to Market: Sustainable Food Supply for Health in the Era of Transformation Technologies | March 19, 2018
Harnessing New Technology for Sustainable Food Supply - ASEAN and Indonesia Perspectives

Points to be discussed:

- ASEAN?
- Sustainable Food Supply?
- New Technology?
- Closing: ASEAN/Indonesia perspective?

Association of Southeast Asian Nations (ASEAN)

- Now: Total of 10 Countries
  - Indonesia, Malaysia, Philippines, Singapore & Thailand
  - Brunei Darussalam, Vietnam, Laos, Myanmar & Cambodia
Association of Southeast Asian Nations (ASEAN)

- The ASEAN Vision 2020:
  
  "The ASEAN Economic Community (AEC) shall establish ASEAN as single market and production base"

- The ASEAN Integrated Food Security Framework:
  - To ensure long-term (sustainable) food security and to improve the livelihoods of farmers in the ASEAN region.
Association of Southeast Asian Nations (ASEAN)

- The ASEAN Integrated Food Security Framework:
  - To ensure long-term (sustainable) food security and to improve the livelihoods of farmers in the ASEAN region.

Objectives:

- To increase food production
- To reduce post-harvest losses
- To promote conducive market and trade
- To ensure food stability
- To operationalise regional food emergency relief arrangements

Harnessing new Technology to
To meet these Objectives?

Definition of Sustainability

Sustainability is a path of continuous improvement, wherein the products and services required by society are delivered with progressively less negative impact upon the Earth

Schuster, D. 2008
(Institute for Sustainability)
Definition of Sustainable Food Systems

“A sustainable food system is a food system that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised”.

The High Level Panel of Experts on Food Security and Nutrition (HLPE), the science-policy interface of the UN Committee on World Food Security (CFS)

Definition of Food Security

... a condition when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life.

World Food Summit (1996)

... the fulfillment of food needs for every individual, in term of quantity, quality, safety, diversity, nutritive value, availability and affordability, as well as in term of its compliance with religion, belief and culture, to live healthy, active and productive in a sustainable manner

Indonesian Food Law, Law No 18, 2012
Ultimate objective of Food Security

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Indonesian Food Law, Law No 18, 2012

# Individual with healthy, active and productive life, in a sustainable manner.
Ultimate objective of Food Security

PREVALENCE OF UNDERNOURISHMENT IN THE WORLD BY REGION, 2000–2016

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Ultimate objective of Food Security

Basic Health Research (riskesdas) 2007, 2010 and 2013

The prevalence of malnutrition, stunted, and under/overweight of infants, Indonesia

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Breeding → Seed → “Farming”
Agronomy, Climate/Environment → Harvest
Crops/Animals → Products → Ingestion/Consumption
Postharvest Treatment/Handling/Storage → Processing, Packaging, Distribution → Preparation

Individual capable to live healthy, active and productive in a sustainable manner.

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Harnessing New POST-HARVEST Technology for Food Security

Post Harvest Technologies

→ refer to the stabilization & storage of unprocessed or minimally processed foods from the time of harvest

Technology to

- Minimize losses and waste
- Maintain and assure quality
- Maintain and assure safety
- Add value and spread value

Individual capable to live healthy, active and productive in a sustainable manner.
Harnessing New POST-HARVEST Technology for Food Security

**Solutions to Global Food Security: Reducing Post-Harvest Food Losses**

William Beny M.Md and Melissa Newman

Global food security is approaching a crisis point in many locations around the world, especially in African countries. It is imperative that a comprehensive approach be adopted that not only considers appropriate technological solutions, but also institutional solutions that will ultimately deliver success. With an increase in global population to over nine billion by 2050, the need for enhanced strategic food availability is paramount. Food security is a major concern in large parts of the developing world. Food production must ideally increase significantly to meet the future demands of an increasing and more affluent world population (FAO, 2011). This has placed a great strain on major agricultural-producing countries to provide the world’s food supply, to a point where innovation solutions that are culturally appropriate must be devised and implemented globally to ensure continued food security.

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American Meat Science Association

Increasing Food Availability by Reducing Postharvest Losses of Fresh Produce

A.A. Kader
Department of Pomology
University of California
Davis, CA 95616
USA

Keywords: deterioration factors, fruits, loss estimation, socioeconomic factors, vegetables

Abstract

Quantitative losses (such as loss of caloric and nutritive value, loss of acceptability by consumers, and loss of edibility) are more difficult to measure than qualitative losses of fresh fruits and vegetables. While reduction of quantitative losses is a higher priority than qualitative losses in developing countries, the opposite is true in developed countries where consumer dissatisfaction with produce quality results in a greater percentage of the total postharvest losses. Providing consumers with fruits and vegetables that taste good can greatly increase their consumption of the recommended minimum of five servings per day for better health. Development of new cultivars with better flavor and nutritional quality plus adequate productivity should be given high priority in all countries. Strategies for reducing postharvest losses in developing countries include: (1) Application of current knowledge to improve the handling systems (especially packaging and cold chain maintenance) of horticultural perishables and assure their quality and safety; (2) Overcoming the socioeconomic constraints, such as inadequacies of infrastructure, poor marketing systems, and weak R&D capacity; and (3) Encouraging consolidation and vertical integration among producers and marketers of horticultural crops.
Food Security

Harnessing New POST-HARVEST Technology for Food Security

Increasing Food Availability by Reducing Postharvest Losses of Fresh Produce

A.A. Kader
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Estimated postharvest losses of fresh horticultural food crops in developing countries

<table>
<thead>
<tr>
<th>Location</th>
<th>Range (%)</th>
<th>Mean (%)</th>
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<tbody>
<tr>
<td>From production to retail Sites</td>
<td>5-50</td>
<td>22</td>
</tr>
<tr>
<td>At retail, foodservice, and consumer sites</td>
<td>2-20</td>
<td>10</td>
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<td>Cumulative (Total)</td>
<td>7-70</td>
<td>32</td>
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</table>

Food Security

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Innovative approaches: --Postharvest treatments

- Chemical treatments (1-MCP, C2H4, sanitizers, etc.)
- Physical treatments (irradiation, hot air/water, etc.)
- Impacts on food safety and consumer perception
Innovative approaches: --Packaging

Temperature Limit Indicator

A temperature limit or "threshold" indicator give a signal when a certain temperature limit is exceeded.

→ a temperature limit indicator shows a color (or other visible) indication once 45°F is exceeded.

Source: [http://www.vitsab.com/htdocs/VITcompare.htm](http://www.vitsab.com/htdocs/VITcompare.htm)
Harnessing New POST-HARVEST Technology for Food Security

Innovative approaches: --Packaging

Time-Temperature Integration Indicator
(Also known as TTI)

TTI determines the end point based on the time-temperature history (area under the curve). “A” has a long time run than “B”, although the time-temperature history is the same.

Unlike the temperature limit indicator, TTI will not be triggered when the temperature reaches a certain limit.

Source: [http://www.vitsab.com/htdocs/VITcompare.htm](http://www.vitsab.com/htdocs/VITcompare.htm)

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Harnessing New POST-HARVEST Technology for Food Security

Innovative approaches: --Storage

- Environmental control (temp, RH)
- Atmospheric gas control (O2, CO2)
- Pressure control (hypobaric storage)
Harnessing New **POST-HARVEST** Technology for Food Security

Innovative approaches: -- **Transportation**

- Cold Chain system → Refrigerated truck/container
- MA Container
- Aseptic Container

Processing Technology to:

- Assure supply of value-added food products
- Comply with food safety and sustainability standard & practices
- Meet consumer need for product quality, convenience, availability and affordability
- Provide optimum "health" effects

Individual capable to live healthy, active and productive in a sustainable manner.
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Alternative-Emerging Food Processing Technologies (FDA/IFT 2000)
http://www.fda.gov/Food/FoodScienceResearch/SafePracticesforFoodProcesses/ucm100158.htm

- Microwave and Radio Frequency
- Ohmic and Inductive Heating
- High Pressure Processing
- Pulsed Electric Field
- High Voltage Arc Discharge
- Pulsed Light
- Ultraviolet Light
- Ultrasound
- X-Rays
Harnessing New PROCESSING Technology for Food Security

Alternative-Emerging Food Processing Technologies (FDA/IFT 2000)

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Food Packaging
Food Irradiation
Biotechnology
Omic-Technologies: Nutrigenomic
Nano-Technology
Ingredient Technology

Equivalency of alternative technologies

Questions of Interest
- Process Description?
- Mechanism of Activation?
- Critical Factors and Quantification?
- Process deviations?
- Organisms of concern?
- Indicator organisms?
- Main research need?

Generator (Oscillator)

Food Material

“Ionic displacement
“Change of Orientation Polarization”
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Equivalency of alternative technologies

<table>
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<tr>
<th>Questions of Interest</th>
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### Harnessing New PROCESSING Technology for Food Security

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#### Temperature vs Heating Time

- **Conventional Thermal processing**
- **HTST**
- **LTST**

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### Harnessing New PROCESSING Technology for Food Security

#### Equivalency of alternative technologies

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![Diagram showing the equivalency of alternative technologies](image)

#### Technology of High Hydrostatic Pressure

- **~36000 psi (~250 Mpa)**
- **~87000 psi (~600 Mpa)**

- High Pressure can kill microorganisms by interrupting with their cellular function without the use of heat that can damage the taste, texture, and nutritional value of the food.

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#### Equivalency of alternative technologies

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First order kinetics for thermal or pressure denaturation and inactivation of LOX. Denaturation is followed by determining band intensity of the major band in the electropherogram; inactivation is followed by measuring spectrophotometrically the enzyme activity.

* = denaturation at 64°C; o = inactivation at 64°C; △ = denaturation at 600 Mpa, 20°C; □ = inactivation at 550 MPa and 20°C.


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Equivalency of alternative technologies

Technology of High Hydrostatic Pressure

Thermally-assisted high-pressure lifts quality of shelf-stable foods

Pressure (Mpa)

Food Security
Harnessing New PROCESSING Technology for Equivalency of alternative technologies

Technology of High Hydrostatic Pressure

Ultra-high-pressure inactivation of prion infectivity in processed meat: A practical method to prevent human infection

Paul Breen1, Richard Meyers2, Franco Cardone3, and Mascia Pochiar3

1National Institutes of Health, Bethesda, MD 20892, USA; 2Washington University, St. Louis, MO 63130, USA; and 3University of Rome, Rome, Italy

Abstract: We report the inactivation of PrPSc in processed meat by the high-pressure processing technique. The method was applied to a variety of meat products, including beef, pork, and chicken, and was shown to be effective in inactivating PrPSc at pressures up to 600 MPa. The inactivation was confirmed by Western blots and immunohistochemistry.

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**Harnessing New PROCESSING Technology for Food Security**

Change of anti-nutrition compound in soybean during Irradiation at certain dose-rate

**Graphs:**

(a) Phytic Acid
(b) Antitripsin activity

**Data:**

- **Phytic Acid**
  - Dose rates: 1.30 kGy/hr, 3.17 kGy/hr, 5.71 kGy/hr, 8.82 kGy/hr
  - Ln[C/C awal] as a function of time (Waktu iradiasi) in hours.

- **Antitripsin activity**
  - Dose rates: 1.30 kGy/hr, 3.17 kGy/hr, 5.71 kGy/hr, 8.82 kGy/hr
  - Ln[AAT/AAT awal] as a function of time (Waktu iradiasi) in hours.

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Change of color (brightness) of soybean and soybean flour during Irradiation at different dose-rate

(a) Soybean grain  (b) Soybean flour

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(a) Soybean grain  (b) Soybean flour

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Role of International TRADE for Food Security

FINALLY ........
Harnessing New Technology for Food Security

The Challenges:

How to assure supply of value-added food products,
• To comply with food safety and sustainability practices?
• To meet consumer need for product quality, convenience, availability and affordability?
ASEAN & Indonesia Perspective:

- Improved innovation system
- Improved assessment system for new (food and feed) technologies
  - Improved network for facilitating application of new technology
- Improved education system
  - Food technology curriculum

FINALLY ........
Harnessing New Technology for Food Security

ASEAN & Indonesia Perspective:

- Improved food regulatory system
- Scientific approaches and parameters for the assessment of the new technologies, and
- Develop the equivalence of many alternative technologies in term of its sustainability and safety is a must.
ASEAN & Indonesia Perspective:

• Improved **food regulatory system**
• Scientific approaches and parameters for the assessment of the new technologies, and
• Develop the equivalence of many alternative technologies in term of its sustainability and safety is a must.

and ...

• **Harmonized/alligned food safety/sustainability standards**