

AVRDC The World Vegetable Center

34th International Vegetable Training Course
 "Vegetables: From Seed to Table and Beyond"
 14 September to 4 December 2015

**FRESH-CUT
 FRUIT & VEGETABLES**



Dr. Apita Bunsiri : rdiyep@ku.ac.th
 Postharvest Technology Center, Faculty of Agriculture at Kamphaengsaen,
 Nakhon Pathom 73140 THAILAND

3-November-2015

AVRDC The World Vegetable Center

Convenience Foods
 Food that needs little preparation :
 Easy to Cook / Ready to Eat

Shorten the time of meal preparation at home:
 Some can eat immediately or after adding water,
 heating or thawing: canned, dried, frozen produce and
Fresh-Cut Fruit and Vegetable

APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

**Why Do The People Need
 Convenience Foods?
 (Fresh-Cut Fruit and Vegetables)**

- ☺ **Price** Cost reduction
- ☺ **Health** Neutraceutical
- ☺ **Hygiene** Minimize risk and hazard
- ☺ **Lifestyle** Efficiency : We are all busy, we want food on the go
- ☺ **Choice** Exotic fruit and vegetable



APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

Why do we NEED to do fresh cut?

- ▶ **Market (Consumers) Need**
 - The haste in daily life
 - Convenience food / easy to cook / easy to eat
 - Too big-fruit / Difficult to peel
 - Belief in quality and safety
- ▶ **Understandard produces (defect, size, color, etc.)**
 - Gain income / Value added
- ▶ **Reduce garbage transportation**
 - Value added from waste

APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

DEFINITION
 (IFPA, 2000 ; Watada *et al*, 1996 ; Rolle and Chism,1987)

Fresh-cut products :

Fruits or vegetables **intended to be consumed raw** that have been **trimmed, peeled, sliced, shredded, cored and/or cut** into 100% usable product that is subsequently **packaged** to offer consumers high nutrition, conveniences and flavor while **maintaining highly perishable freshness**. The tissue is still alive!!

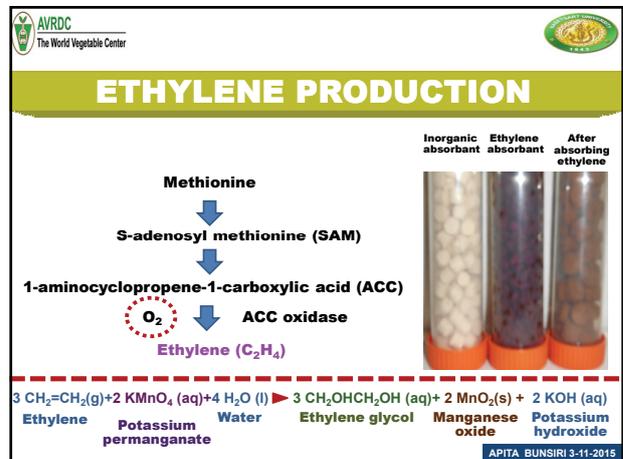
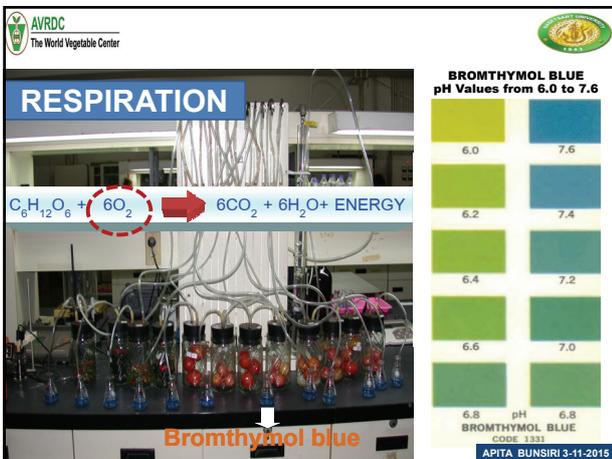
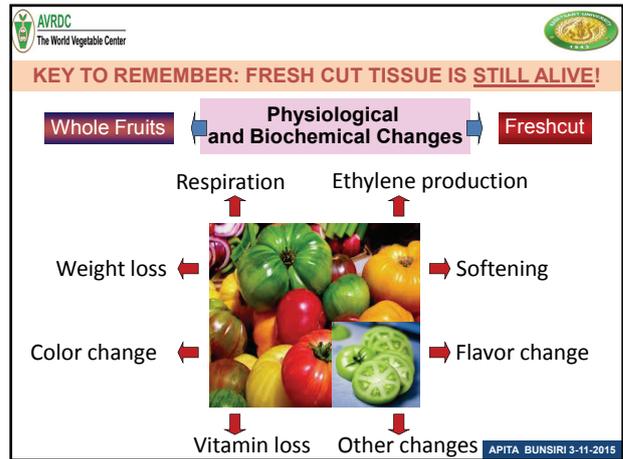
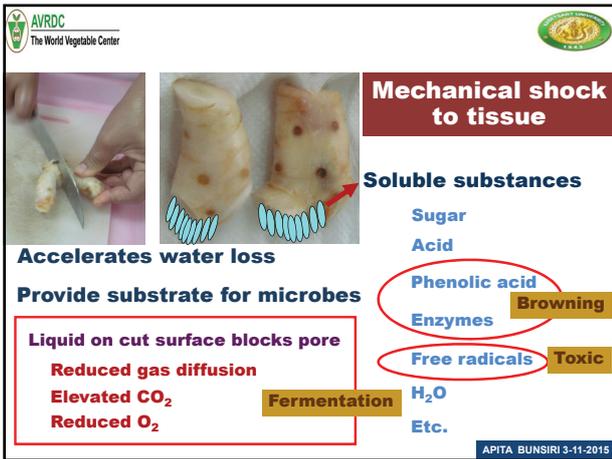
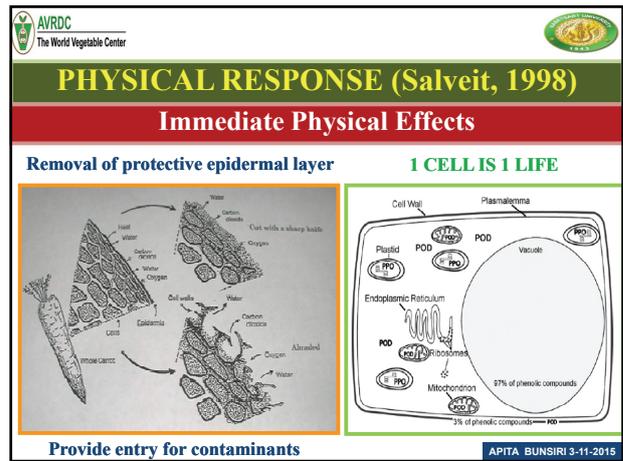
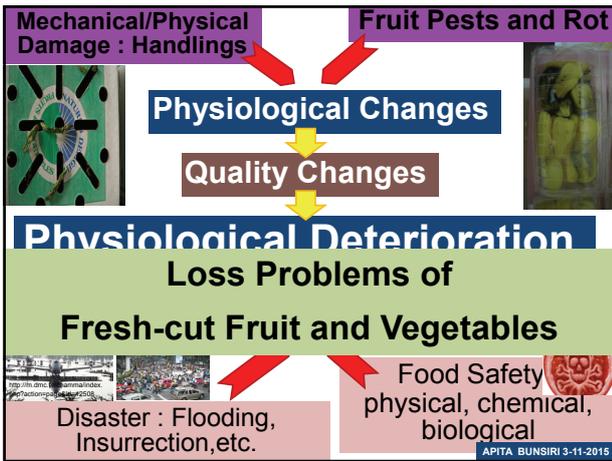
APITA BUNSIRI 3-11-2015

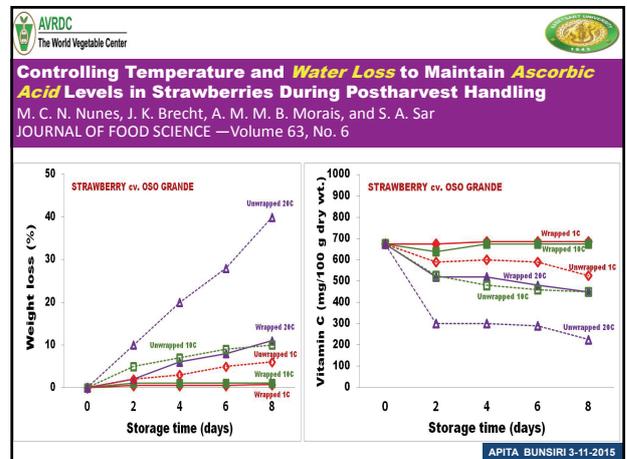
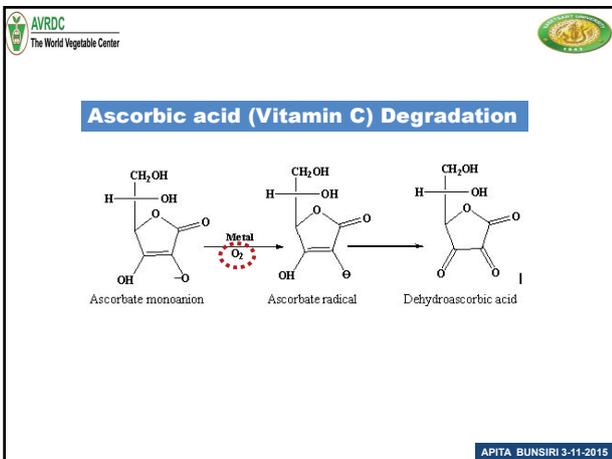
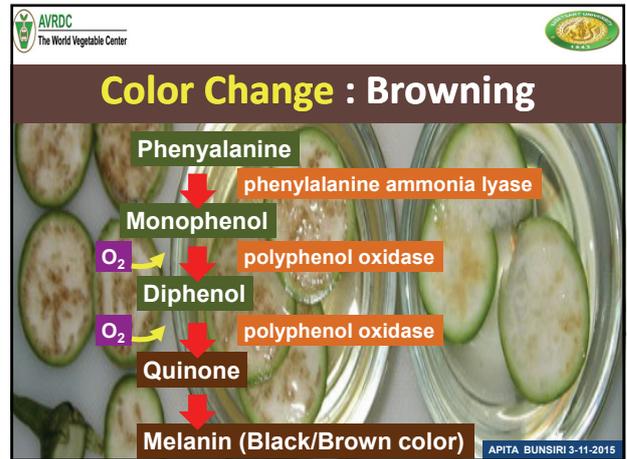
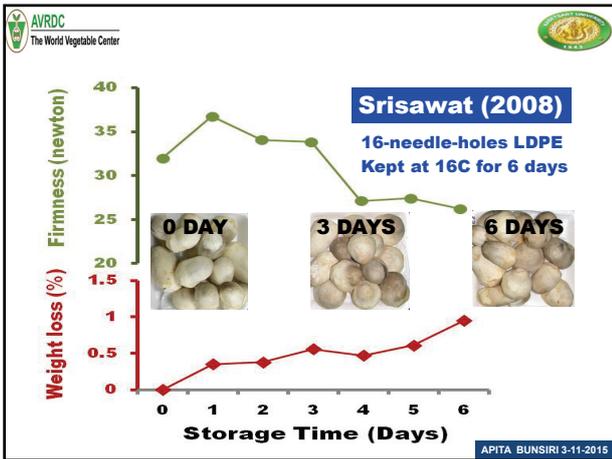
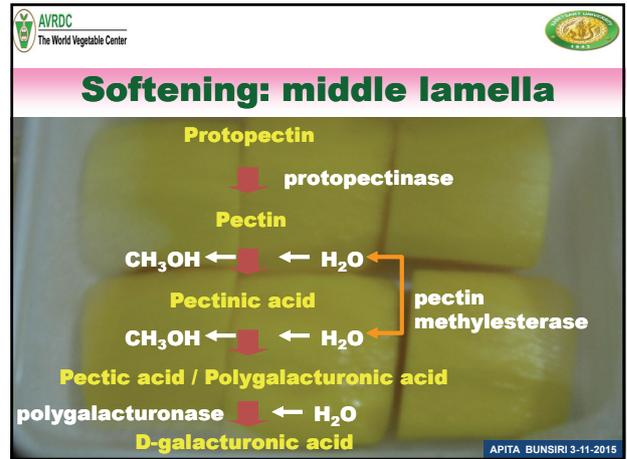
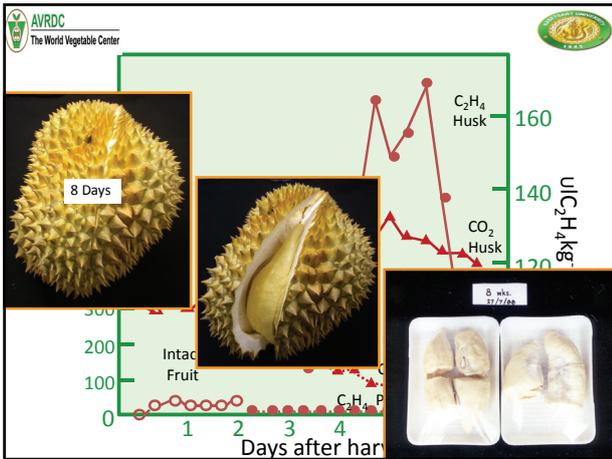
AVRDC The World Vegetable Center

WOUND FROM FRESH CUT



APITA BUNSIRI 3-07-2015







Foodborne pathogen found on fresh-cut jackfruit with and without edible solution coating stored at 12°C for 12 days

Pathogen	Standard guideline	Treatments	Day0	Day12
Aerobic plate count	$6 \times 10^5 \text{ CFU/g}$	Control	4.00×10^4	6.70×10^5
		RF-I	8.78×10^3	6.60×10^4
		RF-II	3.40×10^3	2.40×10^5
Coliform bacteria	$6 \times 10^5 \text{ CFU/g}$	Control	4.00	1.10×10^5
		RF-I	0.00	1.20×10^4
		RF-II	0.00	2.40×10^1
Yeast	10^4 CFU/g	Control	1.60×10^1	2.10×10^3
		RF-I	0.00	4.00
		RF-II	1.80×10^1	3.10×10^3
Mold	10^4 CFU/g	Control	0.00	4.00×10^2
		RF-I	0.00	4.00
		RF-II	0.00	4.00

S. aureus *E. coli* *Salmonella* spp. Control RF-I RF-II nd

APITA BUNSIRI 3-11-2015

Residues (ppm) of pesticides in various portions of unwashed carrots

Portion	Cypermethrin	Diazinon	Parathion
Whole carrot	0.012 (1X)	0.016 (1X)	0.035 (1X)
Crown	0.12 (10X)	0.25 (16X)	0.82 (23X)
Peel	0.021 (1.8X)	0.039 (2.4X)	0.059 (1.7X)
Peeled carrot	nd (0X)	nd (0X)	nd (0X)

Burchat et al., 1998, Food Additives and Contaminants, 15(1):61

APITA BUNSIRI 3-11-2015

Mechanical/Physical Fruit Pests and Rot Dam

SOME : Can Control

SOME : Out of control

Insurrection, etc. biological

APITA BUNSIRI 3-11-2015

How to produce Good Convenience Foods (Fresh-cut Fruit and Vegetables)

APITA BUNSIRI 3-11-2015



AVRDC The World Vegetable Center

FRESH CUT

▼

Problem???

*Easy technique
Save and Safe*

Learn Understand Solve
Plants

APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

What Kind of produce?

What are the problems that increase produce losses?

How can we solve these problems? (Directly/Indirectly)

APITA BUNSIRI 3-11-2015

Mechanical/Physical Damage : Handlings

Fruit Pests and Rot

Physiological Changes

Quality Changes

Physiological Deterioration

Loss Problems of Fresh-cut Fruit and Vegetables

Disaster : Flooding, Insurrection, etc.

Food Safety physical, chemical, biological

APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

Food Safety starts from the farm

Physical Damage, Physiological and Biochemical Changes protect by **Good Handlings** from farm to fork

Sanitization including modified atmosphere packaging under suitable temperature and relative humidity need for **DISEASE** control and **Quality** maintenance

However, investment depends on producers' status

APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

Straw mushroom sold in the supermarket was deteriorated within 1 day at 5°C

Water soaking of straw mushroom occurred after storing at 15°C for 6 days

6 Days : LDPE

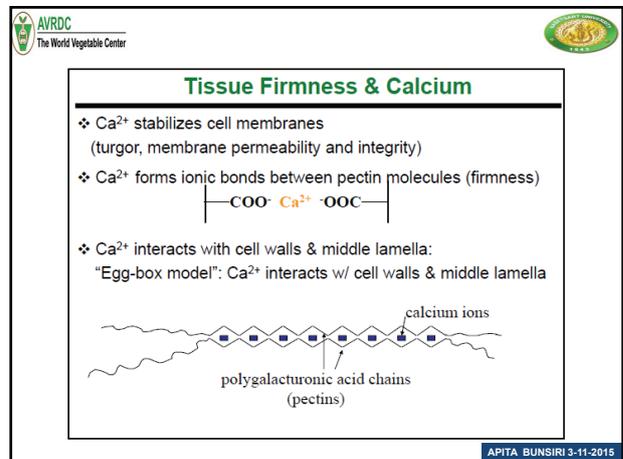
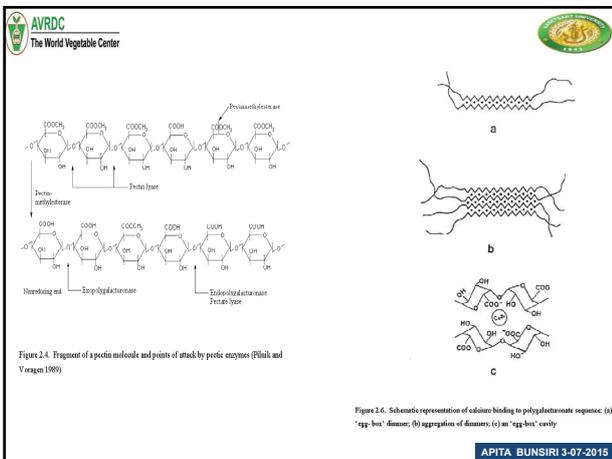
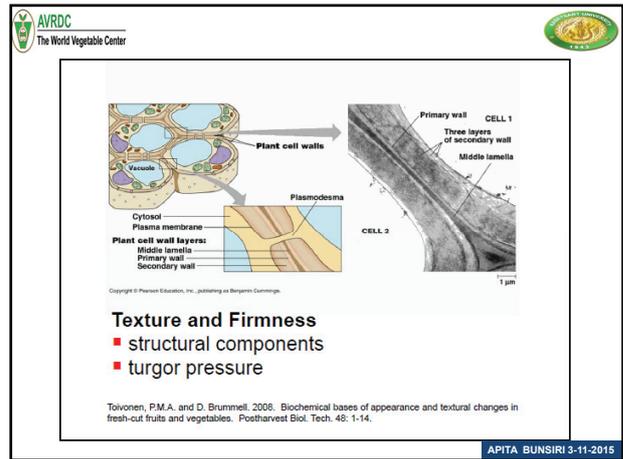
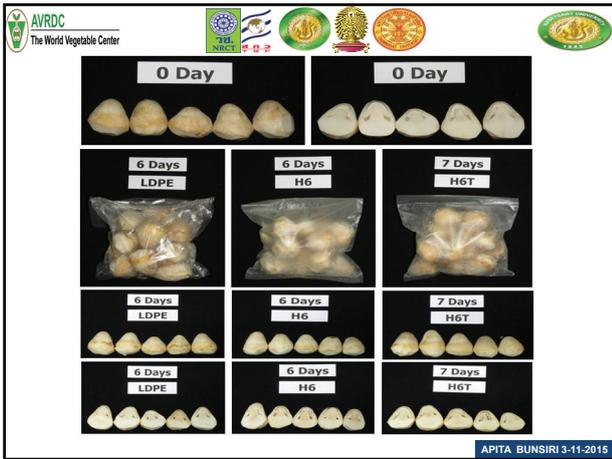
APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

Room Temp	10°C	12°C	14°C	16°C	18°C	20°C	22°C
10 Days	10°C	12°C	14°C	16°C	18°C	20°C	22°C
15 Days	10°C	12°C	14°C	16°C	18°C	20°C	22°C
20 Days	10°C	12°C	14°C	16°C	18°C	20°C	22°C

Straw mushroom kept at 10, 12, 14, 16, 18 °C and RT

APITA BUNSIRI 3-11-2015



AVRDC The World Vegetable Center

12 DAYS

Pathogen	Standard	Treatment	Day 0	Day 11	Day 11	Day 11
Aerobic plate count	< 8 x 10 ⁵	Control	4.9 x 10 ⁶	2.8 x 10 ⁶	8.7 x 10 ⁶	1.8 x 10 ⁷
		Ready-to-eat	2.18 x 10 ⁵	2.6 x 10 ⁵	1.6 x 10 ⁵	1.9 x 10 ⁵
E. coli	< 24 CFU/g	Control	1.4 x 10 ⁸	4.3 x 10 ⁸	2.4 x 10 ⁸	4.1 x 10 ⁸
		Ready-to-eat	0	0	0	0
Listeria	< 8 x 10 ³ CFU/g	Control	4	1.2 x 10 ⁴	1.1 x 10 ⁴	1.8 x 10 ⁴
		Ready-to-eat	0	2.8 x 10 ³	1.2 x 10 ⁴	1.9 x 10 ⁴
S. aureus	< 24 CFU/g	Control	0	1.2 x 10 ⁴	2.4 x 10 ⁴	8.7 x 10 ⁴
		Ready-to-eat	0	0	0	0
Yeast	< 11 ⁶ CFU/g	Control	1.4 x 10 ⁸	4.9 x 10 ⁸	2.3 x 10 ⁸	7.9 x 10 ⁸
		Ready-to-eat	0	4	2.3 x 10 ⁴	1.7 x 10 ⁵
Mould	< 100 CFU/g	Control	0	0	440	2584
		Ready-to-eat	0	0	0	2584
Salmonella	162.5 g	Control	17.4 x 10 ⁶	10.1 x 10 ⁶	10.1 x 10 ⁶	20.1 x 10 ⁶
		Ready-to-eat	0	0	0	0

CONTROL READY FRESH1 READY FRESH2

APITA BUNSIRI 3-07-2015

AVRDC The World Vegetable Center

Browning : Enzyme Activity

monophenol (colorless)

$PPO + O_2$

Reducing agents : sulphiting agents, ascorbic acid and analog, cysteine, glutathione

diphenol (colorless) ↔ o-quinone (color)

PPO activity $PPO + O_2$

amino acids/proteins

Organic acids/Acidulants/Chelators : citric acid, malic acid, tartaric acid (lowering pH<4)

Complex brown polymers

APITA BUNSIRI 3-07-2015

AVRDC The World Vegetable Center

Coconut : Using GRAS solution instead of SMS to delay browning

Sink for 5 minutes and keep at 2°C

3 Weeks at 2°C

Tr.1 sodium metabisulfite 3% (control)	Tr.2 ascorbic acid 3.5%+ citric acid2.5%	Tr.3 oxalic acid 3%+benzoic acid 0.2%	Tr.4 oxalic acid 3% + acetic acid 0.5%
--	--	---------------------------------------	--

APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

Browning : Water Loss

APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

Sharp Razor

Dull Knife

(Tatsumi & Watada, 1991)

APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

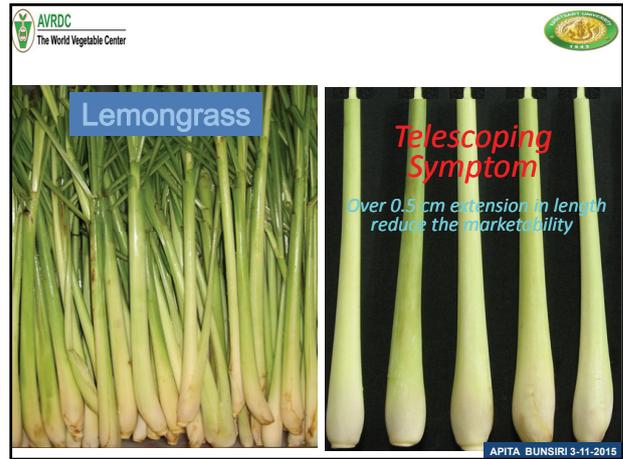
PROBLEM : WATER LOSS

BROWNING

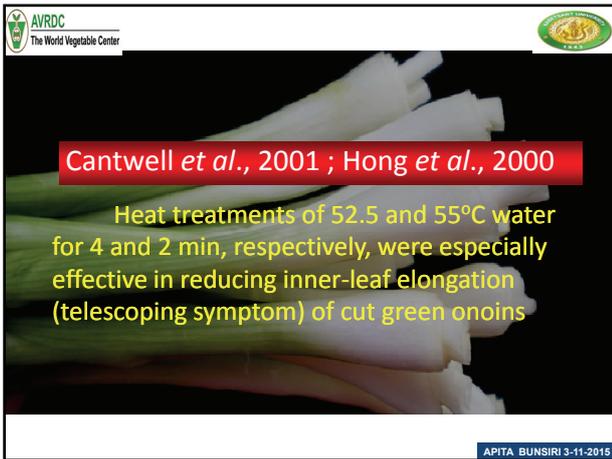
APITA BUNSIRI 3-11-2015



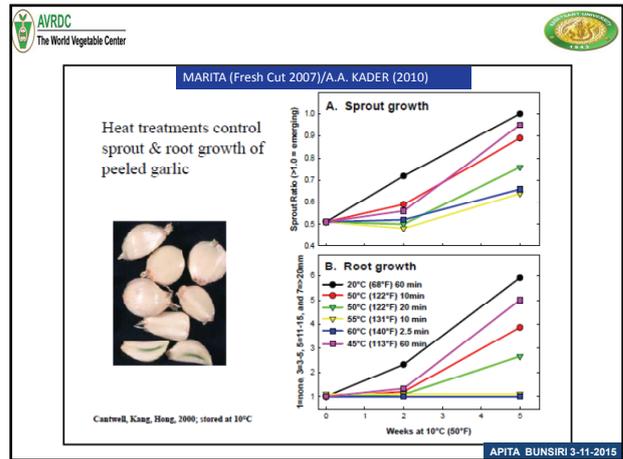
APITA BUNSIRI 3-11-2015



APITA BUNSIRI 3-11-2015



APITA BUNSIRI 3-11-2015

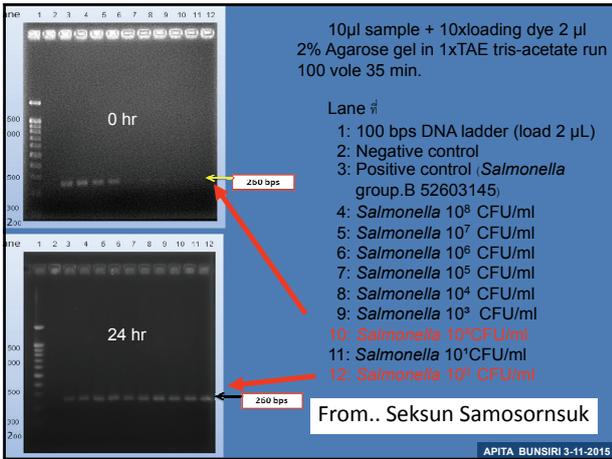


APITA BUNSIRI 3-11-2015

Treat.	Salmonella sp.	Total plate count	Total coliform	E. coli	Yeast
Established guidelines*	N.D.	<6x10 ⁶	1x10 ⁷	<20	<1x10 ⁴
Initial microbe	N.D.	8.66x10 ⁷	19.60	4	10.67
MSRL2 Control	N.D.	3.20x10 ⁸	38.67x	0	5.31x10 ⁴
52-3	N.D.	1.14x10 ⁶	14.33x	0	1.21x10 ⁶
67-5	N.D.	4.93x10 ⁶	14.33x	0	5.22x10 ⁶
55-3	N.D.	5.07x10 ⁶	2.93x	0	2.52x10 ⁶
55-5	N.D.	3.00x10 ⁶	2.90x	0	2.84x10 ⁶

APITA BUNSIRI 3-11-2015

APITA BUNSIRI 3-11-2015



AVRDC The World Vegetable Center

USE INDICATOR FOR DETERMINING THE DETERIORATION DEGREE

-RIPENING

<http://www.dailymail.co.uk/news/article-1127504/Colour-coded-sensor-labels-tell-customers-perfect-time-eat-fruit.html>

APITA BUNSIRI 3-11-2015

RISK OF MICROBIAL CONTAMINATION

MICROBIAL INDICATOR

Metabolite : CO₂, SO₂, NH₄, H₂S, Organic acid (acetic, lactic) + pH Dye

Oxalis triangularis

Pigment indicator pH 4.0-5.0 + Alginate as absorber

Guideline : pH ≤ 4.6

Starch and sugar ⇒ Lactic acid (pH ≤ 4.6)
Lactobacillus

SAFE DANGER

Salmonella spp
Bacillus cereus
Staphylococcus aureus
Listeria monocytogenes
Escherichia coli O157:H7
Yersinia enterocolitica

http://www.mtec.or.th/index.php?option=com_content&task=view&id=1016&Itemid=176

APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

MICROBIAL INDICATOR

Metabolite : Alcohol (ethanol) + Enzyme ⇒ Substrate + Color Dye
Amine (thiramine)

http://www.tistr-foodprocess.net/download/article/food_safety_issues_th.htm

APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

Maintain quality & shelf life of fresh product

1. Use highest quality raw material
2. Minimize mechanical damage/sharp knife
3. Rinse cut surface/remove excess water
4. Maintain strict sanitation/chlorinated water
5. Use appropriate package and atmosphere
6. Maintain product quality at 1-5°C

APITA BUNSIRI 3-11-2015

AVRDC The World Vegetable Center

THANK YOU

APITA BUNSIRI 3-11-2015