Enhancing Postharvest quality and shelf life of locally-grown vegetables

Helena Pontes Chiebao
Cary Rivard
Eleni Pliakoni
Department of Horticulture and Natural Resources, Kansas State University

KANSAS STATE UNIVERSITY

Fresh fruits and vegetables

In the last 2 decades:

- Fresh fruits per capita consumption increased 19%
- Fresh vegetables (including potatoes) 29 %

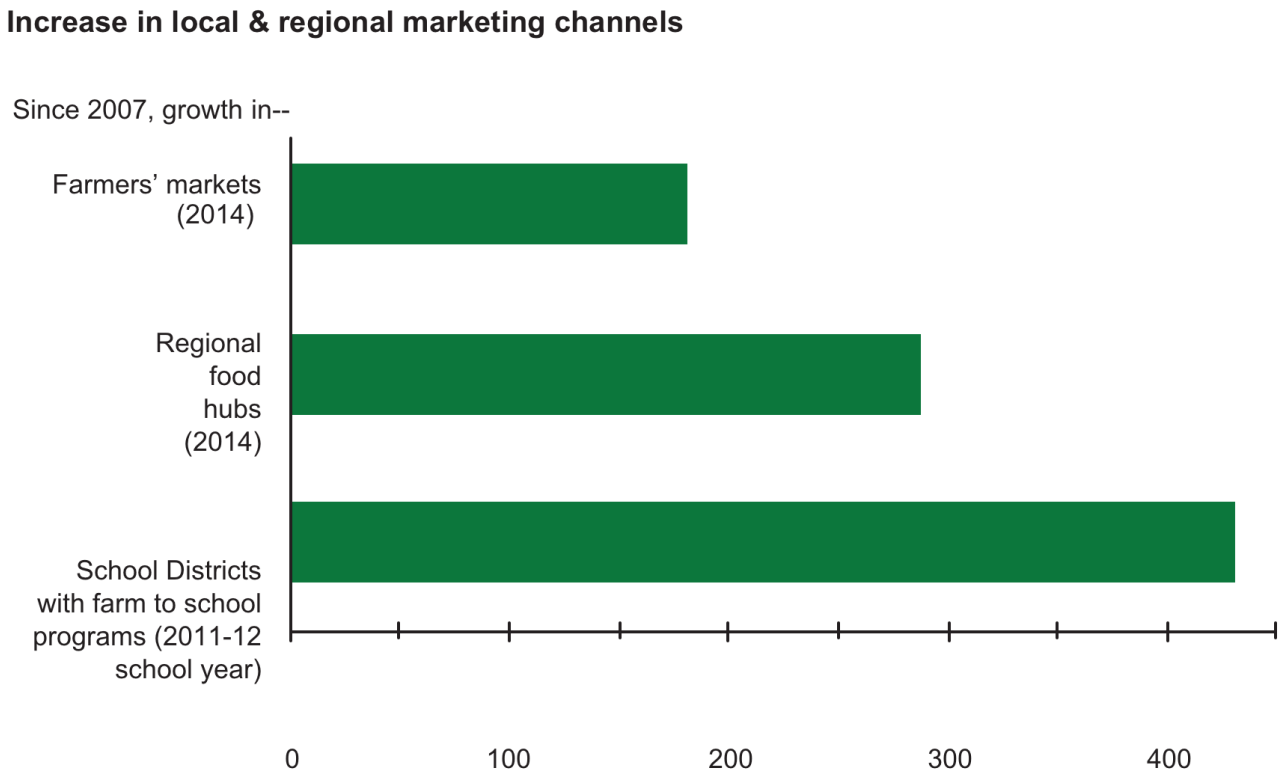
Demand of local food

Local and regional food sales in the U.S. totaled US $6.1 billion in 2012

7.8% of U.S farms sold food thought local food market channels

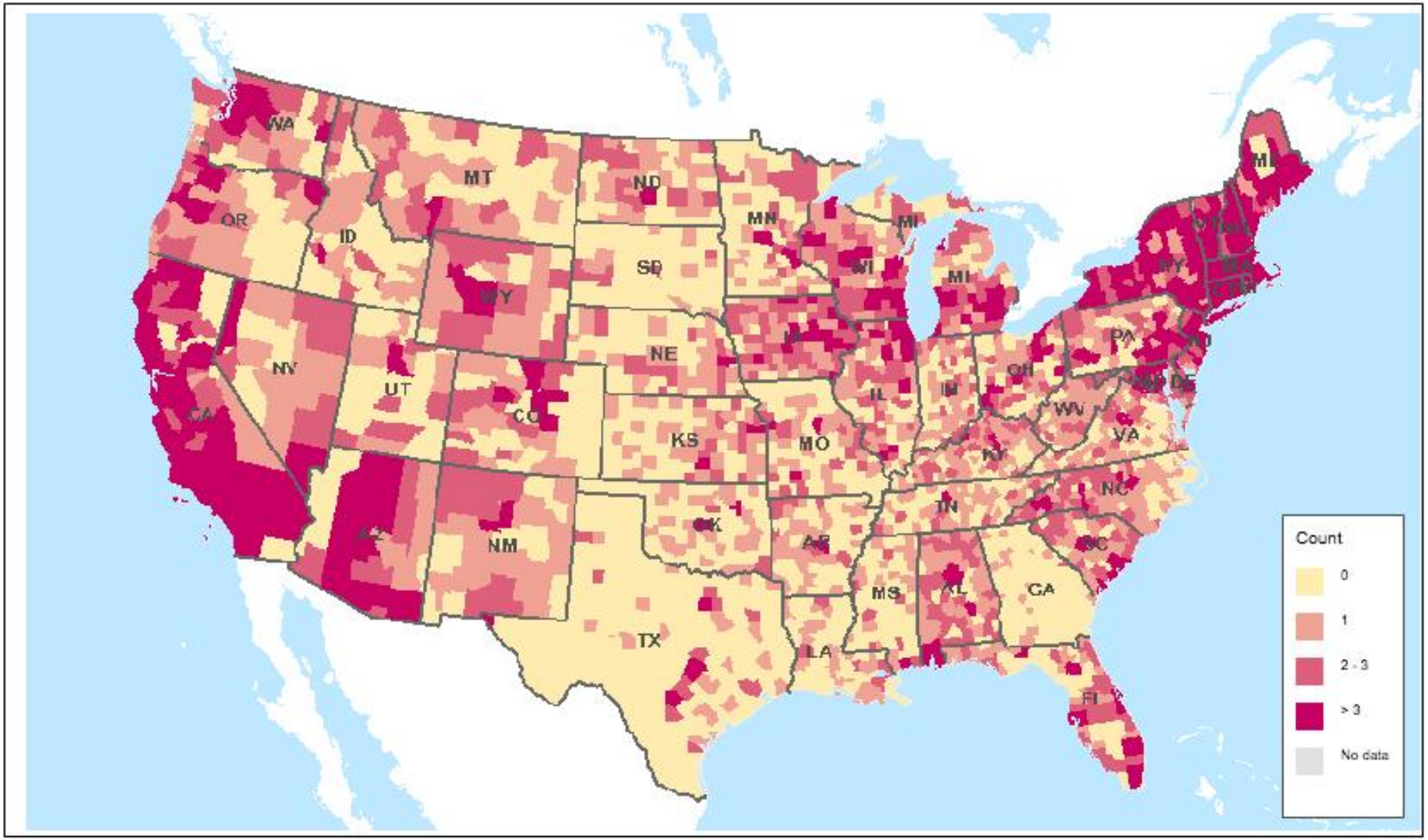
KANSAS STATE UNIVERSITY

Increasing consumption of local food

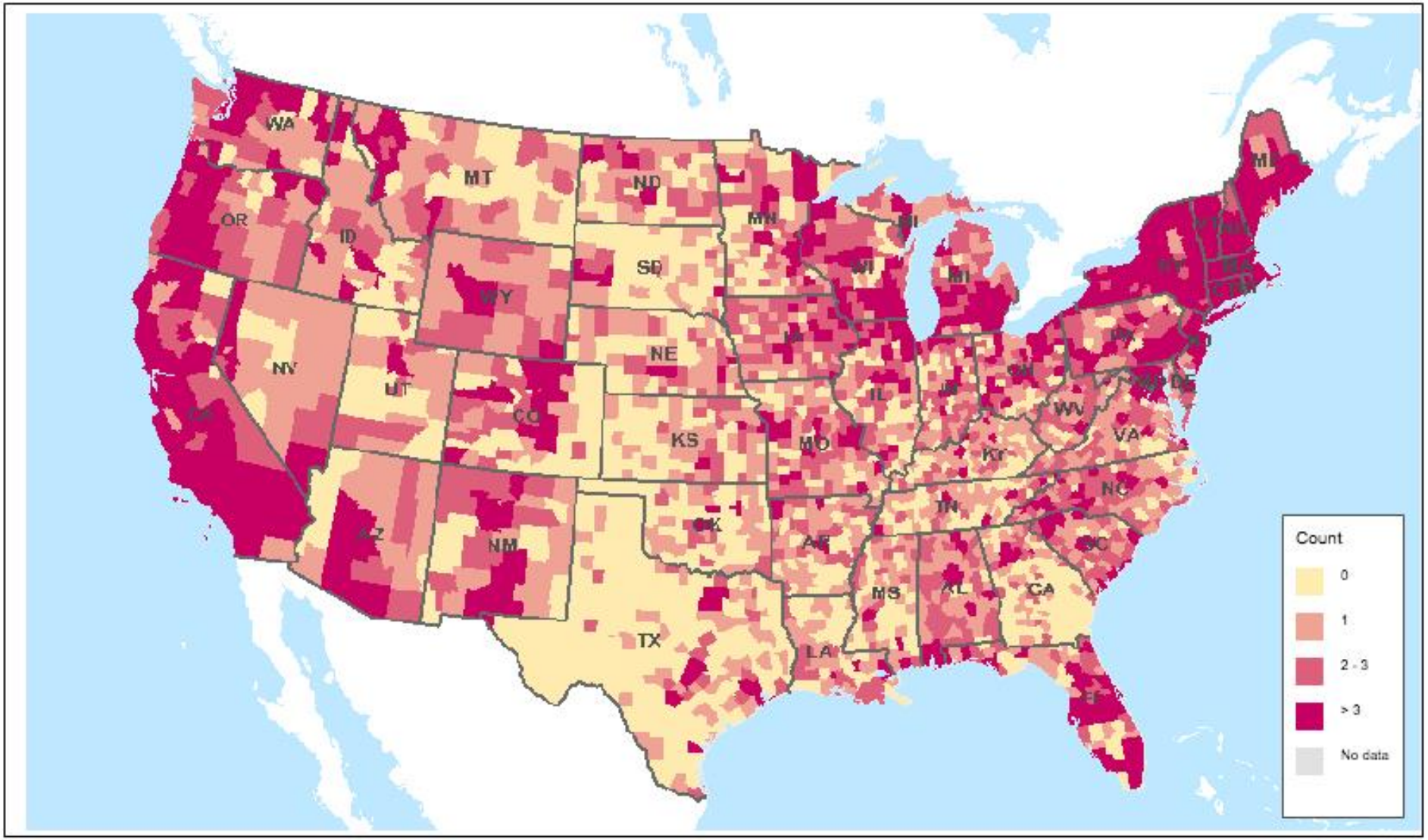


Sources: USDA, Agricultural Marketing Service, Food Nutrition Service; National Farm to School Network.

KANSAS STATE UNIVERSITY



Farmers' markets, 2009



Farmers' markets, 2013

Challenges for scaling up

- product volume
- quality
- consistency
- variety, or extended availability
- lack of distribution
- storage
- processing
- marketing infrastructure

Solution?

- No “one-size-fits-all” approach

Production systems

KANSAS STATE UNIVERSITY

- High tunnels:
  - Extend the harvest season
  - Increase marketability (fewer cracks, splotches and other aesthetic defects)
  - Prevent losses?
  - Nutritional quality?
  - Shelf life ?

United States Department of Agriculture
National Institute of Food and Agriculture

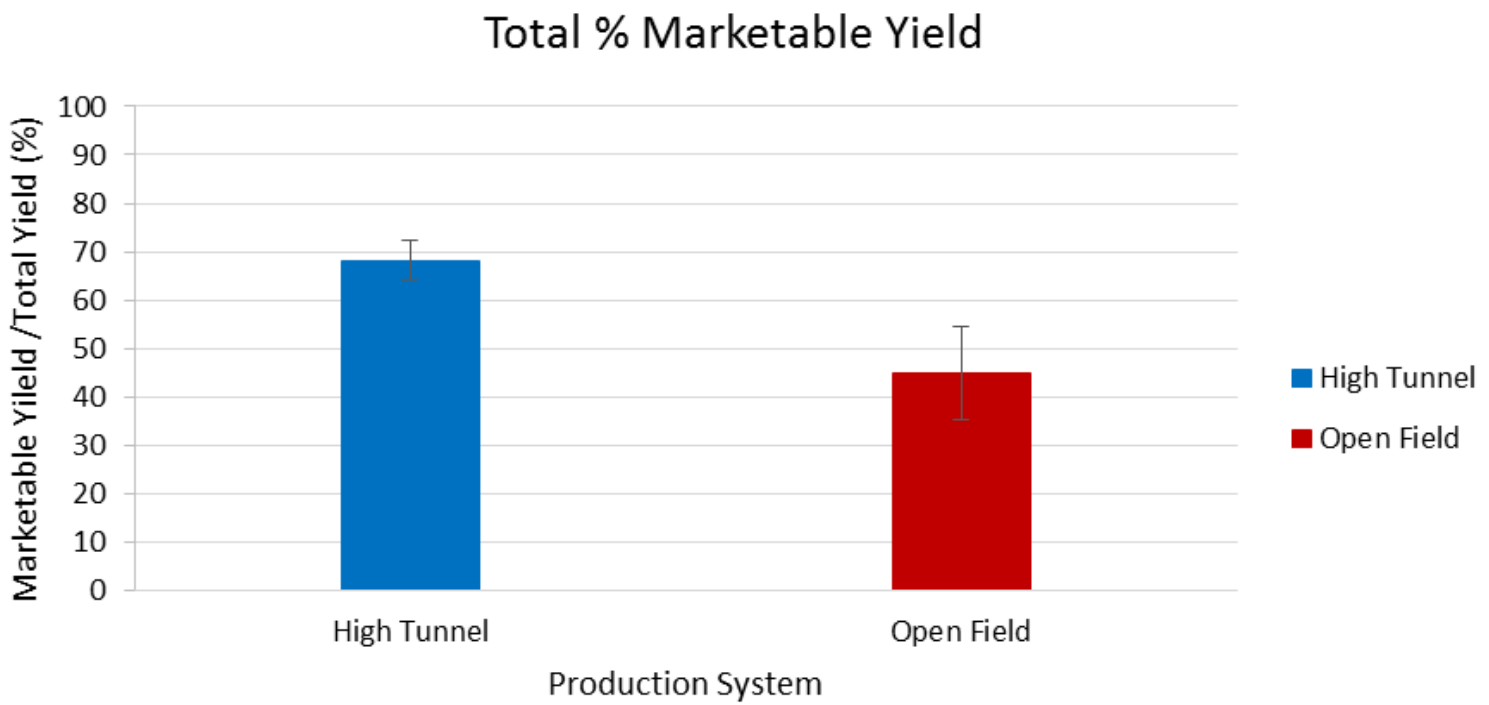
UF UNIVERSITY of FLORIDA
KANSAS STATE UNIVERSITY

2014 – 2016 Yield and Marketable Yield

	Fruit Yield (# per plant)				Fruit Yield (lbs per plant)				% Marketability			
	Marketable		Total		Marketable		Total		Number		Weight	
Main Effects												
High Tunnel	35.1	A	49.8	A	23.0	A	20.4	A	64.5%	A	65.3%	A
Open Field	13.2	B	20.6	B	20.3	B	10.9	B	52.8%	B	57.0%	B
Simple Effects												
High Tunnel Cherokee Purple	28.3	C	42.7	C	12.3	C	18.3	B	61.5%	B	61.8%	B
Open Field Cherokee Purple	9.1	A	16.7	A	5.4	A	10.1	A	46.0%	A	51.0%	A
High Tunnel BHN589	41.9	D	56.8	D	18.0	D	22.6	C	67.5%	B	68.9%	B
Open Field BHN589	17.2	B	24.6	B	8.4	B	11.8	A	59.6%	AB	63.0%	B

USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture
UF UNIVERSITY of FLORIDA
KANSAS STATE UNIVERSITY

2015-2016 Total % Marketable Spinach Yield

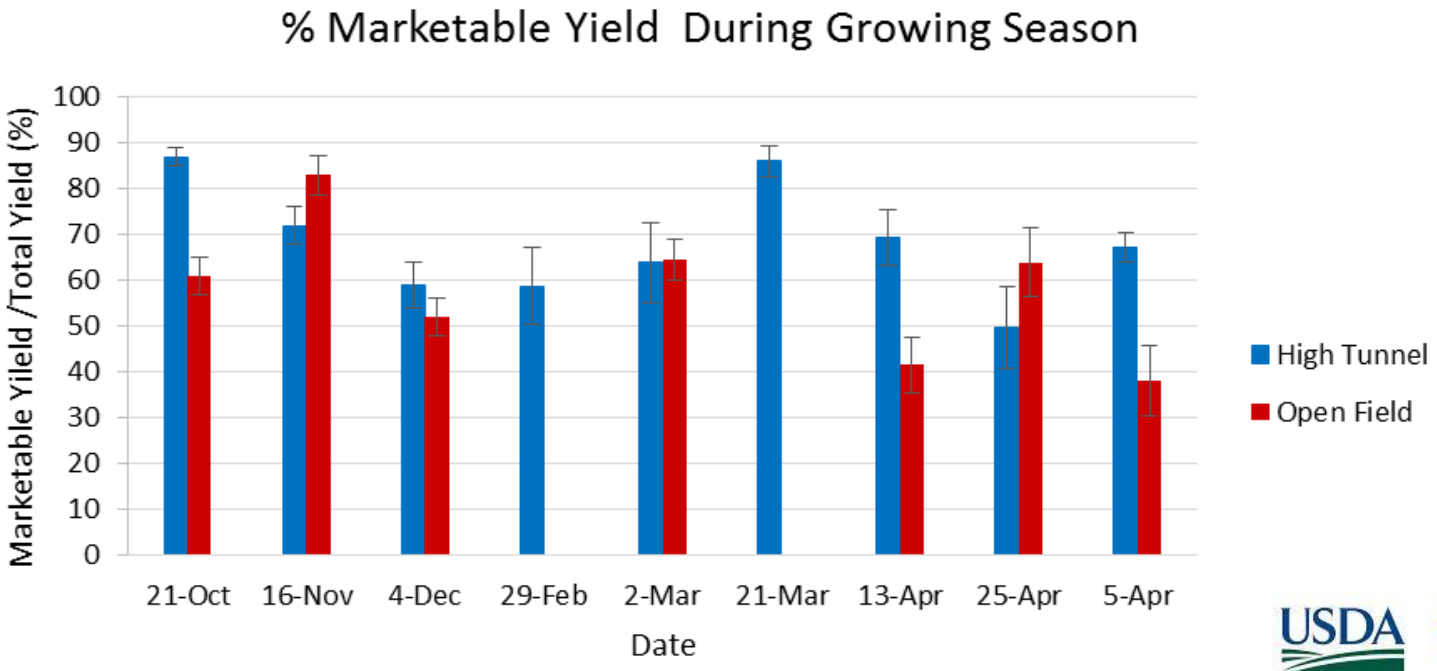


United States Department of Agriculture
National Institute of Food and Agriculture

UF UNIVERSITY of FLORIDA

KANSAS STATE UNIVERSITY

2015-2016 Total % Marketable Spinach Yield During The Growing Season



United States Department of Agriculture
National Institute of Food and Agriculture

UF UNIVERSITY of FLORIDA

KANSAS STATE UNIVERSITY

BHN589 at 25°C at day of harvest

	High Tunnel	Open Field
Sugar/acid ratio	12.13 (2.51)	9.84 (1.71)
Antioxidant capacity (ORAC)	776.29 (131.82)	762.49 (55.53)
Antioxidant capacity (FRAP)	293.50 (42.53)	284.21 (22.99)

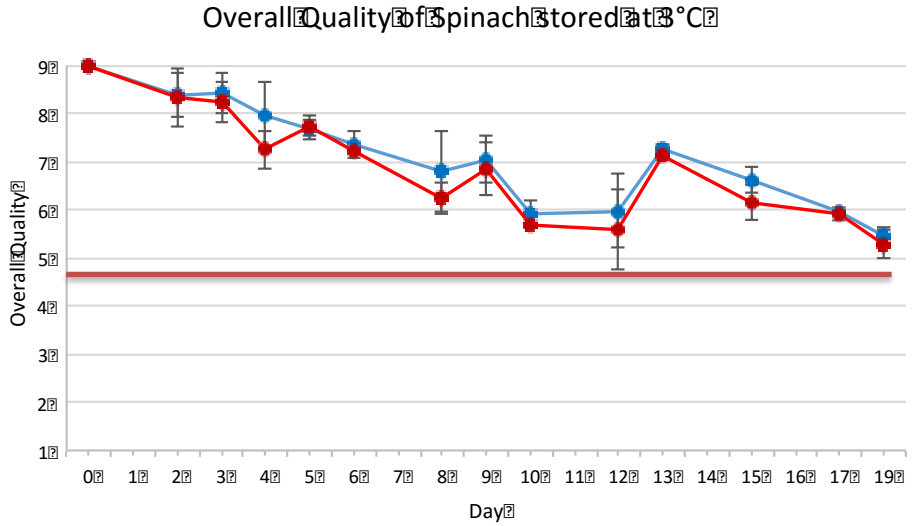
Cherokee purple t 25°C at day of harvest

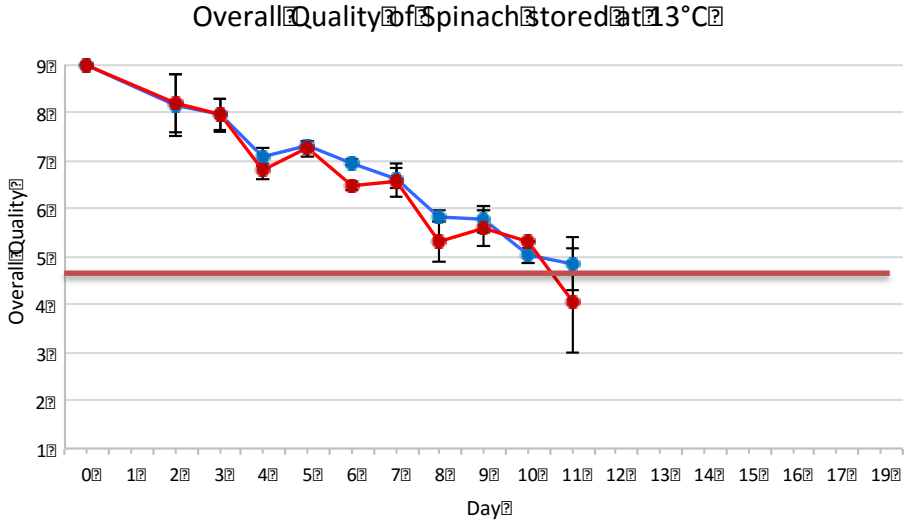
	High Tunnel	Open Field
Sugar/acid ratio	14.56 (3.63)	14.89 (0.73)
Antioxidant capacity (ORAC)	572.36 (75.34)	772.52 (113.38)
Antioxidant capacity (FRAP)	150.36 (12.70)	342.78 (63.36)

USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture

UF UNIVERSITY of FLORIDA
KANSAS STATE UNIVERSITY

Spinach





Average of 3 days shelf life extension

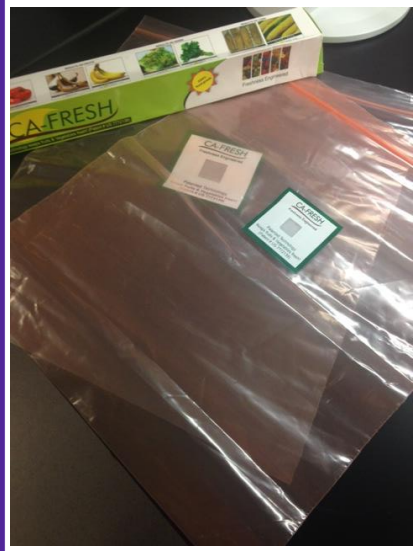
United States Department of Agriculture
National Institute of Food and Agriculture

UF UNIVERSITY of FLORIDA

KANSAS STATE UNIVERSITY

Storage in non-optimum temperatures

- The most common method for prolonging the storage life of fresh fruits and vegetables is temperature control.
  - Low storage temperature decreases the respiration rate, which slows ripening and senescence.



Modified atmosphere packaging (MAP) is a technique that is used as a supplement to, or even a substitute for, refrigeration as a means to prolong the storage life of fresh produce during transportation and retail handling (Kader *et al*., 1989)

Shelf life

Table 2. Shelf life of crops stored at 13°C under different washing treatments combined or not with commercial MAP bags[1].

Treatments	Days		
	Asparagus	Broccoli	Spinach
CC	9.67 (1.53)*[a,b]	5.67 (0.58)[a]	10.25 (2.06)[a]
WC	9.67 (1.53)[a,b]	5.67 (0.58)[a]	13.00 (2.45)[a,c]
OC	10.33 (0.58)[a]	5.33 (0.58)[a]	12.00 (0.00)[a]
CM	12.33 (1.53)[a,b]	12.33 (2.89)[b]	15.50 (1.73)[b,c]
WM	13.00 (1.73)[a,b]	11.67 (3.21)[b]	17.50 (1.00)[b]
OM	12.67 (1.15)[b]	12.00 (0.00)[b]	17.00 (2.00)[b]

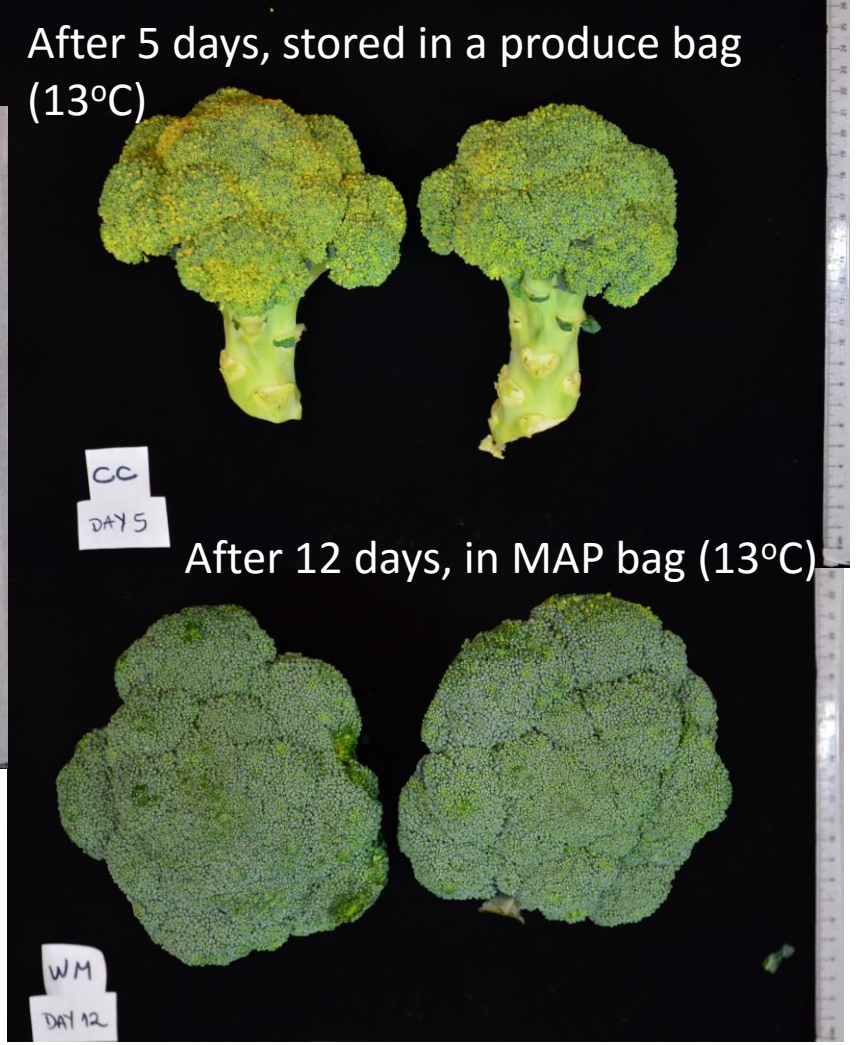
[1]Average (SD) of days of storage of three separate trials, values in column followed by unlike letters are significantly different at $p \leq 0.05$

34%

117%

70%

KANSAS STATE UNIVERSITY



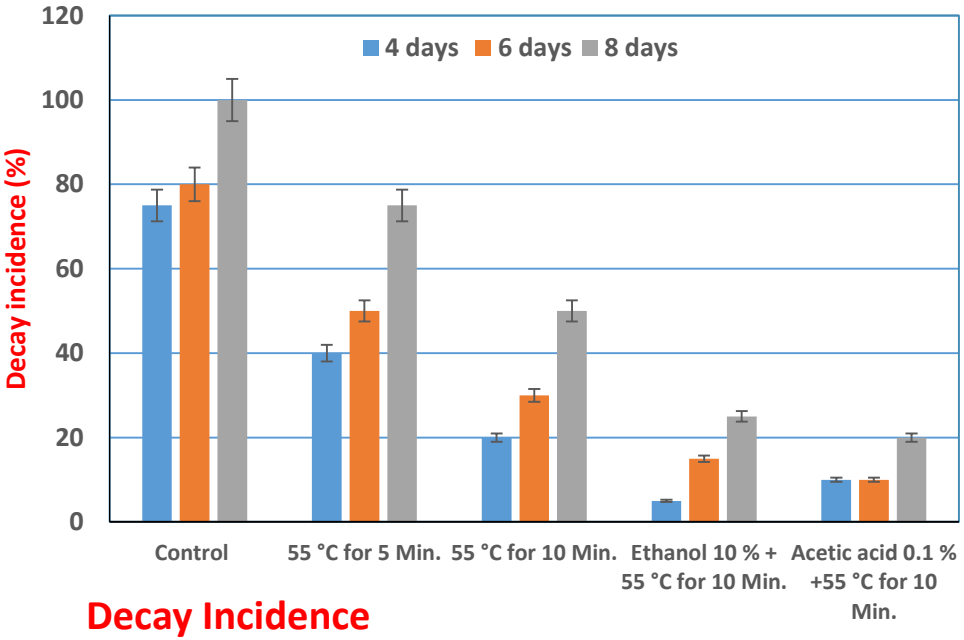
Kansas
Department of Agriculture

Washing

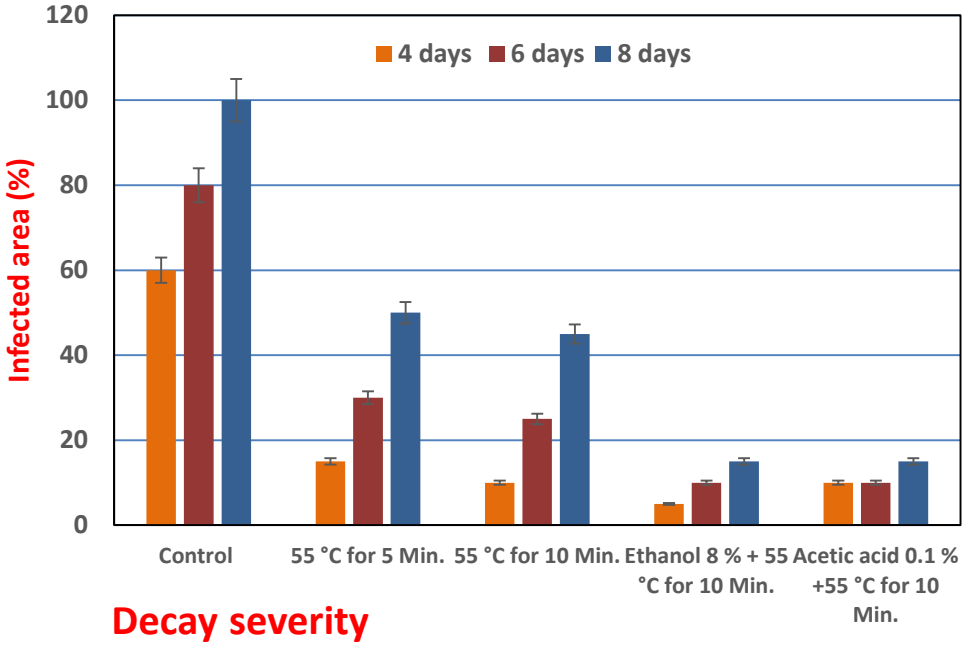
- Potable water
- Chlorination
- Ozonated water

- Hot water
- Others

Results of Dr. Jerry Bartz, UF



Decay Incidence



Decay severity

Erwinia (Pectobacterium) carotovora (Bacterial Soft Rot)

USDA NIFA

United States Department of Agriculture
National Institute of Food and Agriculture

UF UNIVERSITY of FLORIDA

KANSAS STATE UNIVERSITY

The “Kool Kat”


DEPARTMENT OF
HORTICULTURE AND
NATURAL RESOURCES
KANSAS STATE UNIVERSITY
Olathe Horticulture
Research and Extension Center
Kansas
Department of Agriculture

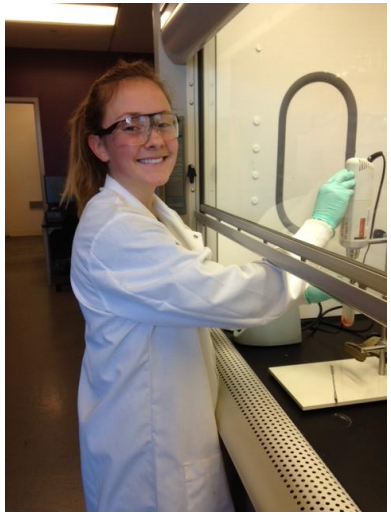

KSU
Hort Center

Conclusions

- Production systems
  - Pre-harvest
  - postharvest
- MAP
- Washing
- Kool Kat

KANSAS STATE UNIVERSITY

Questions ?



KANSAS STATE UNIVERSITY