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Do locally-procured items increase fresh fruit and vegetable consumption: Evidence from a Colorado in-school experiment

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Rural Community Impacts of Farm to School: Food Supply Chains, Educational Programming, and Household Food Purchases [Award # 2017-67023-26246]

United States Department of Agriculture
National Institute of Food and Agriculture

RESEARCH QUESTION: What are the impacts of farm to school programs on farmers and food supply chain businesses, household consumption patterns, and school food choice, consumption and food plate waste?

Research & Extension Team

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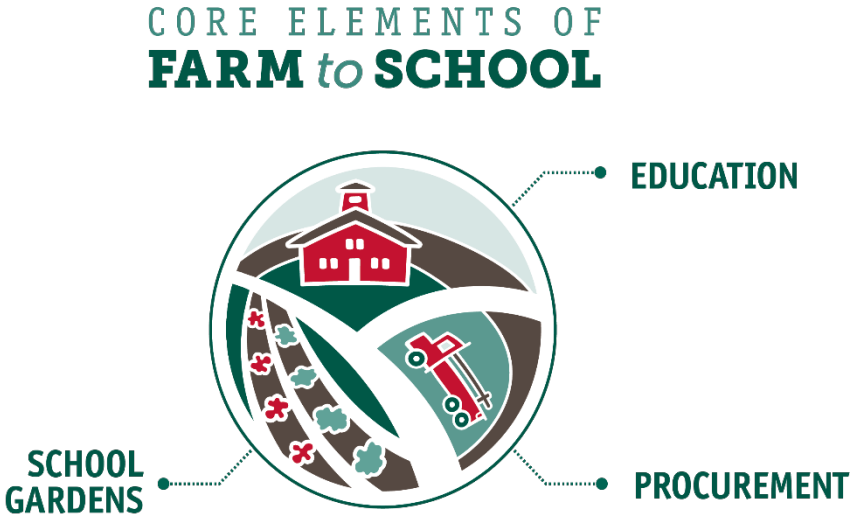
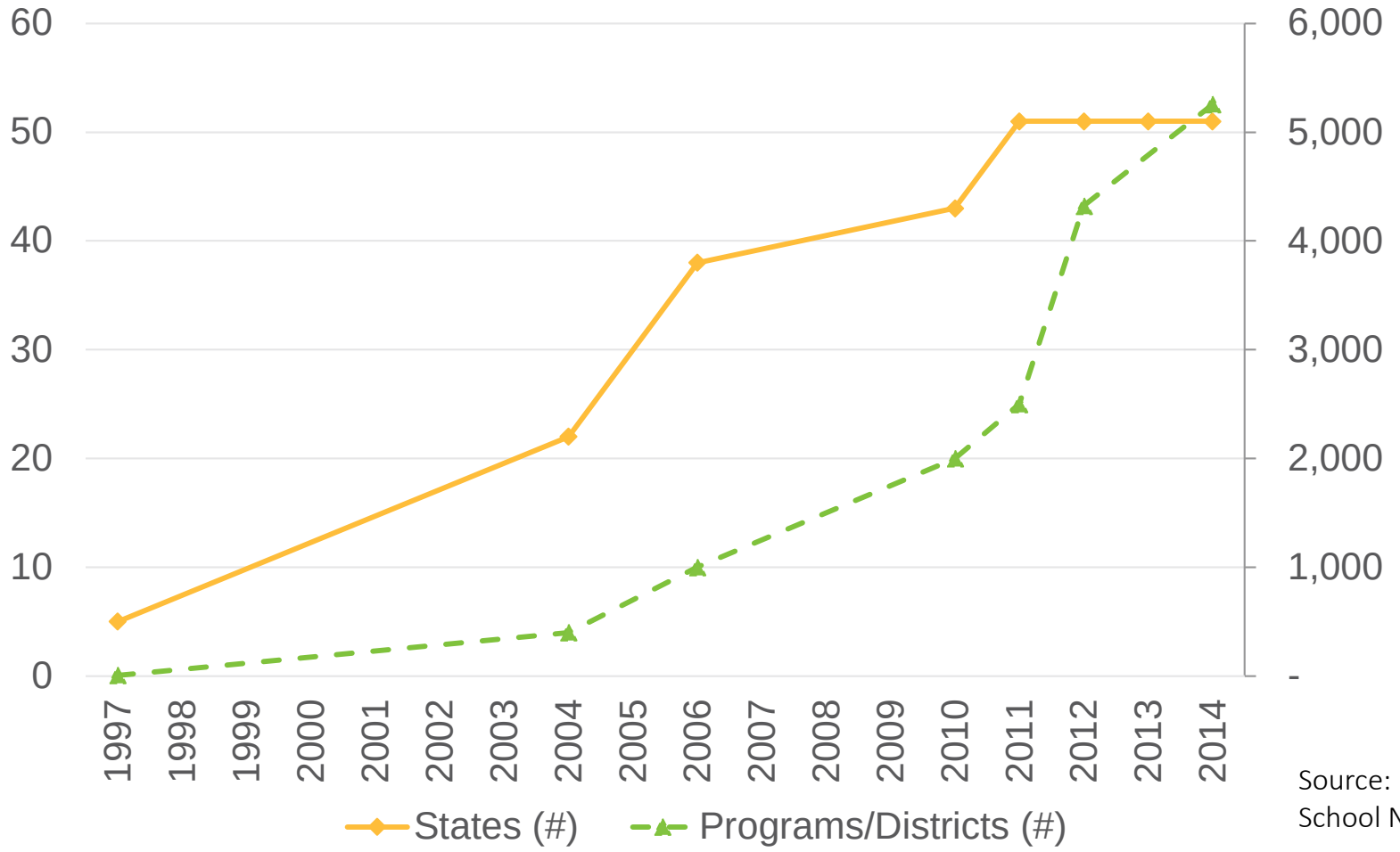
Background: Farm-to-School Programs

- Over 100,000 schools across the U.S.; 30.5 million students
- $12.99 billion in the National School Lunch Program
- 2012: $5 million in mandatory funding for Farm to School Grant Programs (part of 2010 legislation)
- 42% of school districts participate in Farm to School (USDA FNS 2016)



Growth of farm to school programs in U.S., by state and school districts, 1997-2014



Source: National Farm to School Network 2016.

Why Farm to School?

Kids WIN

Objective 3: Pilot in-school experiments to assess how specific FTSPs influence food choice, consumption, and food plate waste.

Farmers WIN

Objective 1: Evaluate if FTSPs result in increased market access and profitability outcomes for farmers and food supply chain businesses.

Communities WIN

Objective 2: Explore patterns in U.S. household exposure to FTSPs and changes in the purchased amounts of foods at home.

Objective 4: Introduce results to research, Extension, practitioner, and policymaker audiences.

Objective

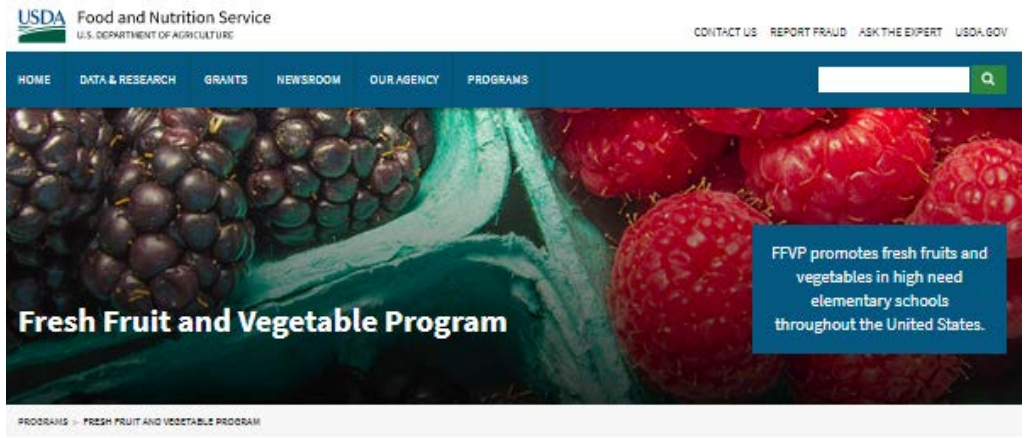
The overall goal of this pilot study is to evaluate how local product sourcing affects consumption of fresh fruits and vegetables in elementary schools.

Underlying assumption: local products are fresher and taste better, possibly resulting in greater consumption.

Specific research questions:

- Do children consume more/ waste less fresh fruit and vegetables when they are locally procured (from farm to school programs)?
- Can “locally procured” story-telling increase fresh fruit and vegetable consumption?

Background: In School FFVP Experiment



- FFVP is a federally assisted program providing free fresh fruits and vegetables to children in eligible elementary schools.
- Goal of FFVP is to introduce children to fresh fruits and vegetable, including different varieties, to increase overall acceptance and consumption of fresh, unprocessed produce.
- FFVP provide ideal setting for conducting our experiment
  - Fruit and veggie snack during PM break

Background: Weld District 6 (Greeley, CO)

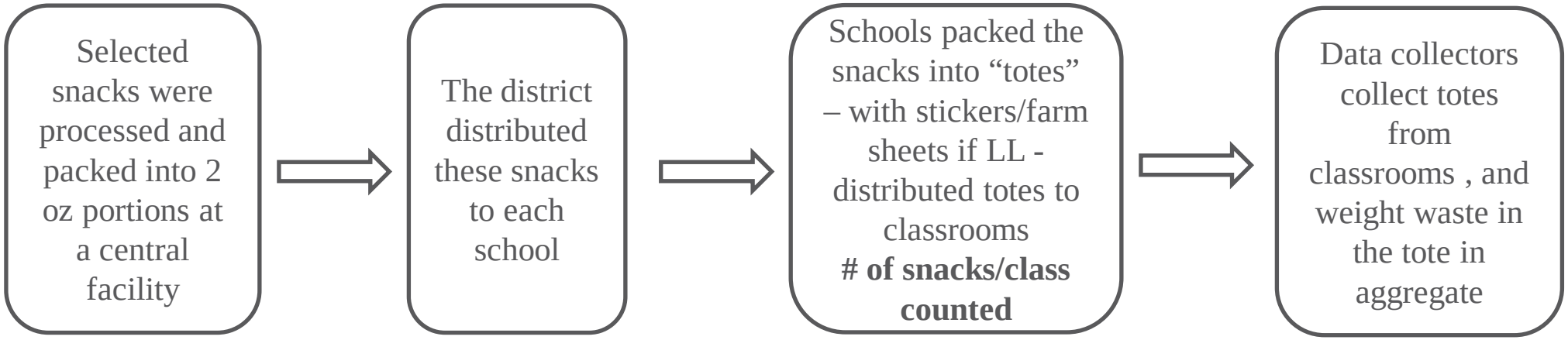
- 66% of students eligible for free and reduced lunch
- Well established farm to school program, including farm to school coordinator/ food hub manager
- District offers >6,000 FFVP snacks to students every Tuesday-Friday of the school year

Methods: Treatment and Products

	1	2	3	4
Products	Apple	Cherry Tomato	Baby Carrot	Bell Peppers
Treatments	Conventional (C)	Local (L)	Local+info (LL)	

- Local: unidentified snacks sourced from within CO.
- Local+ info: Each snack with "CO Proud sticker" and an informational sheet about the source farm was included in the tote for teachers to read to students.

Methods: Data Collection Process



Methods: Data Collection Process

Statistical Unit: Classroom

Impacts of Farm to School

FFVP Consumption Assessment

Whole-School Daily Data and Reference Weight Sheet

(one to be completed per school, per data collection day)

**Please write as clearly as possible and utilize a team read-back system when recording weights.
**Measure all weights in grams to the nearest gram (i.e. 1 g) per capacity of the scale you are using.

School: Centennial Date: 10/11/18

Observers (List All): Haley Dallas, Jenna Scarborough

Product Served (Circle One): Apples Bell Peppers Carrots (Cherry Tomatoes)

Treatment (Circle One): Local (Conventional)

Other notes:

Snack Portion	Snack Item	Did you remove any inedible portion? Y N	Weight Unit – circle	Weight Sample 1	Weight Sample 2	Weight Sample 3	Weight Sample 4	Weight Sample 5	Recorder Initials
Whole Snack	Cherry Tomatoes	n/a	(Bag) Whole Item	56g	45g	108g	73g	54g	JS
Inedible Portion (apple core)	—	n/a	n/a	—	—	—	—	—	
Snack Piece	Cherry Tomatoes	n/a	(Piece)	13g	10g	12g	8g	11g	JS

Selection and Waste Assessment Data Sheet

School Centennial Snack Served tomatos Local Farm? (yes/no/not sure) Date: 10/11/18

Classroom	Number of snacks sent to classrooms	Do bags have stickers? Y/N	Teacher reported Num of Students	Num of unopened snacks	Num of snacks open at all	Num of empty snack bags	Weight (g)	Data collector's Initials	Notes: (use back if needed)
Hernandez	—	N	20	13	6	1	1061	JS	same number as always delivered, 1 bp missing
Graff	26	N	23	16	0	6	961	HLD	
Ketcheson	21	N	—	0	0	0	0	JS	

Methods: Experimental Design (Original)

	Week 1					Week 2					Week 3			
School	Tuesday	Wed	Thursday	Friday		Tuesday	Wed	Thursday	Friday		Tuesday	Wed	Thursday	Friday
1	Apple C	Cherry Tom L	Carrot LL	Bell Pep C		Cherry Tom LL	Carrot C	Bell Pep L	Apple L		Carrot L	Bell Pep LL	Apple LL	Cherry Tom C
2	Apple L	Cherry Tom LL	Carrot C	Bell Pep L		Cherry Tom C	Carrot L	Bell Pep LL	Apple LL		Carrot LL	Bell Pep C	Apple C	Cherry Tom L
3	Apple LL	Cherry Tom C	Carrot L	Bell Pep LL		Cherry Tom L	Carrot LL	Bell Pep C	Apple C		Carrot C	Bell Pep L	Apple L	Cherry Tom LL
4	Cherry Tom C	Carrot L	Bell Pep LL	Apple C		Carrot LL	Bell Pep C	Apple L	Cherry Tom L		Bell Pep L	Apple LL	Cherry Tomato LL	Carrot C
5	Cherry Tom L	Carrot LL	Bell Pep C	Apple L		Carrot C	Bell Pep L	Apple LL	Cherry Tom LL		Bell Pep LL	Apple C	Cherry Tom C	Carrot L
6	Cherry Tom LL	Carrot C	Bell Pep L	Apple LL		Carrot L	Bell Pep LL	Apple C	Cherry Tom C		Bell Pep C	Apple L	Cherry Tom L	Carrot LL
Weekly Procurement														
	Apple C x2	Apple L x4	Cherry Tom C x2	Cherry Tom L x4		Local								
	Carrot L x4	Carrot C x2	Bell Pep x4	Bell Pep C x2		Unshaded = conventional								

Master Plan: Causal identification of treatment effects (L-C, LL-C and L-LL)

- All experiments conducted within a three week timeline (minimize calendar year effects)
- Maintain day-to-day variation in product offerings at each school, including both fruit and veggies
- Account for any week-day effects (say, children eat more on Friday).
- Minimize the number of different products the central kitchen would have to process on a given day

Methods: Experimental Design (Actual)

Logistical (supply chain) challenges curtailed ability to follow experimental design

Date	Product	Source	Information Treatment
10/2/18	Apple	Local	None
10/3/18	Baby Carrots	Local	None
10/4/18	Bell Peppers	Local	None
10/5/18	Cherry Tomatoes	Local	Information
10/9/18	Baby Carrots	Local	Information
10/11/18	Cherry Tomatoes	Conventional	None
10/16/18	Apples	Local	None
10/17/18	Baby Carrots	Local	None
10/18/18	Bell Peppers	Conventional	None
10/19/18	Cherry Tomatoes	Conventional	None
10/23/18	Apples	Local	Information
12/19/18	Apples	Conventional	None
12/20/18	Baby Carrots	Conventional	None

Non-fatal

- Same product delivered to all schools each day
- 2 schools dropped out
  - Still had 4 schools, 86 classrooms

Fatal

- Long time period of experiment
- Local products offered early, conventional products offered close to winter break holiday
- Several missing treatments:
  - no LL pepper
  - no L tomatoes

Methods: Data Records Data Extraction

Variables of interest:

- Average weight of 5 reference weights (by product)
- Number of students reported by teacher (verified by school attendance records)
- Total waste weight
- Extra snacks weight

  = (Number of sent in snacks – number of students) * average reference weight
- Total sent in weight

  = Number of snacks sent to the classrooms * average reference weight
- Total sent in net weight

  = Total sent in weight – Extra snacks weight

Methods: Calculating Consumption and Waste

Food consumption

- Consumption weight per student

$$= \frac{\textit{Total weight sent in} - \textit{Total waste weight}}{\textit{Number of students}}$$

- Percentage of consumption per class

$$= \frac{\textit{Total weight sent in} - \textit{Total waste weight}}{\textit{Total sent in net weight}}$$

Food waste

- Waste weight per student

$$= \frac{\textit{Total waste weight} - \textit{Extra snacks weight}}{\textit{Number of students}}$$

- Percentage of waste per class

$$= \frac{\textit{Total waste weight} - \textit{Extra snacks weight}}{\textit{Total sent in net weight}}$$

Results: Descriptive Statistics

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Consumption Weight per Student by Product

Products	Consumption weight per student		
	Conventionally sourced	Locally sourced unindentified	Locally sourced identified
	mean(s.d)	mean(s.d)	mean(s.d)
Tomatoes	29.59 (13.42)	——	25.64 (16.08)
Apple	91.17 (32.98)	69.51 (29.80)	57.86 (23.64)
Carrots	33.83 (22.64)	41.08 (15.24)	34.76 (14.63)

Note: the unit of "Consumption weight per student " is gram

Percentage Consumed per Class by Products

Products	Percentage of consumption per class		
	Conventionally sourced	Locally sourced unindentified	Locally sourced identified
	mean(s.d)	mean(s.d)	mean(s.d)
Tomatoes	0.49 (0.22)	——	0.45 (0.28)
Apple	0.64 (0.23)	0.58 (0.21)	0.50 (0.21)
Carrots	0.48 (22.64)	0.58 (0.21)	0.51 (0.21)

Results: Descriptive Statistics

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Waste Weight per Student by Product

Products	Waste weight per student		
	Conventionally sourced	Locally sourced unindentified	Locally sourced identified
	mean(s.d)	mean(s.d)	mean(s.d)
Tomatoes	30.31 (13.51)	——	31.32 (16.52)
Apple	52.07 (33.35)	50.97 (29.09)	57.93 (25.96)
Carrots	35.58 (21.95)	29.53 (15.05)	33.36 (14.65)

Note: the unit of "waste weight per student" is gram

Percentage of Waste per Class by Products

Products	Percentage of waste per class		
	Conventionally sourced	Locally sourced unindentified	Locally sourced identified
	mean(s.d)	mean(s.d)	mean(s.d)
Tomatoes	0.51 (0.22)	——	0.55 (0.28)
Apple	0.36 (0.23)	0.42 (0.21)	0.50 (0.21)
Carrots	0.52 (0.32)	0.42 (0.21)	0.49 (0.21)

Results: Focus on tomatoes (LL-C results)

Ttest when product is tomatoes

Key variables	Conventionally sourced			Locally sourced indentified			Difference: (2)-(1)		
	Obs	mean	s.d	Obs	mean	s.d	Obs	mean	s.d
		(1)			(2)			(3)	
Waste weight for per student	110	30.31	13.51	64	31.32	16.52	174	0.50	1.15
Percentage of waste for per class	110	0.51	0.22	64	0.55	0.28	174	0.02	0.02
Consumption weight for per student	110	29.59	13.42	64	25.64	16.08	174	-1.97*	1.14
Percentage of consumption for per class	110	0.49	0.22	64	0.45	0.28	174	-0.02	0.02

Data source: Author's survey.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Next steps

- Controlled experiment focused on the same population

- Effort to triangulate results and see if we really have a ‘null’ result

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