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# **Assessing the Culture of Fresh Produce Safety Within a Leafy Green Producing Community**

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**Abstract:** The 2006 *Escherichia coli* outbreak in spinach prompted the implementation of unprecedented production strategies (Arizona Leafy Green Products Shipper Marketing Agreement) to minimize microbial risk in leafy greens. As the new procedures require assessments of physical intrusion and excrement in fields, outreach was initiated to educate adult (20-35, 35-50, and > 50 years) Yuma, Arizona residents about these guidelines and animal (e.g., pets, horses) stewardship. Pre- and post-assessments revealed that while sensitivity to fresh produce safety improved, adults over 35 years were more industry responsive. Citizen-based outreach programs, in communities where fresh produce is grown, could benefit field-level safety mitigation.

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## **Introduction**

Due to its warm winter climatic conditions, Yuma, located in the Southwest portion of Arizona, is one of the few agricultural regions in the nation where field production of vegetables is possible during the period between November and April. The region represents the bulk of the state's \$3.2 billion vegetable industry, providing food, income, and revenue for a state that ranks second nationally in the production of fresh produce (USDA, 2010). Since the 2006 *Escherichia coli* outbreak in spinach, virtually all Arizona leafy

greens (lettuce, spinach, and others) are being produced following an unparalleled collection of safety practices outlined under the Arizona Leafy Green Productions Shipper Marketing Agreement (AZLGMA). In addition to monitoring soil amendments, irrigation water quality, worker hygiene, and field sanitation, producers are now required to routinely assess physical and animal intrusions, and their excrement in fields.

As a result, it is now essential to educate residents in crop production areas to the reality that minimizing microbial risk is an important issue for all stakeholders, including the general public (Barron, 2009). As public cooperation with growers in and around production areas has been recently heightened (DeWaal & Plunkett, 2007), the objectives of this effort were to (1) determine the necessity to educate citizens about their responsibility to minimize microbial risk in and around produce fields and (2) identify potential target groups that could benefit from a greater understanding of enhanced agricultural practices and public diligence.

## Methods

### Assessment Demographics

Baseline assessments were conducted before the launch of a 2-year fresh produce safety campaign. A 14-question pre-appraisal was administered to 359 Yuma residents (ages 20-35 years, young adults [YA]; 35-50 years, middle-age adults [MAA]; > 65 years, mature adults [MA]). The number of YA, MMA and MA who participated in the assessment was 122, 120, and 117, respectively, equally divided among males and females. The same assessment tool was administered to 135 YA, 126 MAA, and 128 MA following the outreach campaign, with respondents divided equally among gender.

### Educational Outreach

The AZLGMA public relations campaign informed Yuma consumers and residents that leafy green products were grown in accordance with the best food safety practices available today to minimize food-borne illnesses. The outreach campaign provided simple, public-friendly prevention strategies in which residents, youth, and homeowners could participate. A series of 10, 30-second public service announcements were broadcast on local area television stations (KYMA-NBC, KSWT-CBS, Yuma 77 and City73) and popular radio stations (KTTI-FM, KQSR-FM, and KBLU-AM) for an 8-month period. A series of five timely newspaper articles completed the media delivery schemes to the public.

### Assessing Outreach Campaign Impacts

A four-option, forced Likert scaling method (Narli, 2010) (Table 1) was used to measure either positive or negative responses to a series of statements concerning fresh produce safety. Because it was not assumed that respondents perceived the difference between adjacent levels as equidistant, Likert responses were treated as ordinal data and analyzed using the non-parametric Mann-Whitney two-sample and Kruskal-Wallis analysis of variance tests at the 0.05 level of significance. After post-survey screening, 62 respondents were eliminated from the study because they were unaware of the awareness campaign. Analyses of gender and ethnicity were not statistically significant (data not shown).

**Table 1.**

Selected Survey Categories and Questions Used to Assess<sup>1</sup> the Perceptions of Fresh Produce Safety by Residents in a Leafy Green Production Area

<b>Specific Assessment Areas and Questions Used in Pre- and Post-Campaign Assessments</b>
<i>Awareness</i>
I am aware of the economic impact that agriculture has on the general economy of Yuma.
I am aware of the recent interest in the production of safe leafy greens.
Guidelines which reduce microbial risk in leafy green production raise my confidence.
I am specifically aware of the Arizona Leafy Green Marketing Agreement.
I am confident in the safety of Yuma grown leafy greens.
<i>Confidence</i>
I am more confident when purchasing leafy greens when growers adhere to the AZLGMA.
I will change my buying habits as a result of the new leafy green production guidelines.
<sup>1</sup> Likert scale; 1, strongly disagree; 2, disagree; 3, agree; 4, strongly agree

## Major Results

### Improved Fresh Produce Safety Awareness

In general, older adults seemed to have a greater appreciation of agriculture in the area than YA, even prior to the outreach campaign (Table 2). However, in most cases, the outreach campaign produced increased levels of food safety awareness, but not specifically AZLGMA understanding, based on the four categories of food safety knowledge and comprehension.

**Table 2.**

The Sensitivity of Fresh Produce Safety in Response to a Public Relations Campaign That Focused on Awareness of Current Field Production Practices

	Assessment Period <sup>2</sup>	Relative Age <sup>1</sup>			OSL <sup>3</sup>
		Young Adults	Middle-Age Adults	Mature Adults	
Overall Ag Understanding	Pre	3.28 <sup>4</sup> (46.8) <sup>5</sup>	4.79 (56.9)	4.86 (53.6)	0.000
	Post	4.09 (42.9)	4.93 (51.3)	4.85 (54.5)	0.002
	OSL	0.043	0.249	0.541	

Produce Safety Awareness	Pre	2.97 (39.4)	4.01 (52.1)	4.23 (53.1)	0.000
	Post	3.84 (48.6)	4.96 (55.6]	4.77 (57.9)	0.000
	<i>OSL</i>	0.001	0.032	0.049	
Production Guideline Knowledge	Pre	2.68 (37.6)	3.54 (46.4)	3.88 (47.8)	0.000
	Post	3.32 (41.9)	4.14 (51.7)	4.34 (53.8)	0.000
	<i>OSL</i>	0.032	0.021	0.015	
Specific AZLGMA Awareness	Pre	1.82 (23.4)	2.11 (32.7)	2.15 (33.0)	0.091
	Post	2.08 (30.9)	2.31 (35.2)	2.34 (34.7)	0.122
	<i>OSL</i>	0.15	0.24	0.64	
Confidence Level	Pre	3.22 (43.2)	3.86 (54.6)	4.32 (52.4)	0.010
	Post	4.70 (56.7)	4.44 (53.9)	4.32 (53.7)	0.047
	<i>OSL</i>	0.000	0.000	0.000	
Purchasing Behavior	Pre	3.74 (56.1)	3.58 (53.4)	3.79 (56.7)	0.122
	Post	3.94 (51.3)	3.81 (56.1)	3.85 (57.6)	0.297
	<i>OSL</i>	0.265	0.457	0.651	
<sup>1</sup> Young Adults, 20-40; Middle-Age Adults, 40-65; Mature Adults, >65 <sup>2</sup> Pre, Pre-assessment period; Post, Post-Assessment Period <sup>3</sup> OSL: Observed Significance Level <sup>4</sup> Mean Likert scale score <sup>5</sup> Mean ranking score					

## Challenges Influencing Younger Adults

By far, age had the largest influence on food safety appreciation (Table 2). YA seemed to have less awareness and understanding of the new production protocols than MAA and MA, as similarly suggested by Guion, Simonne, and Easton (2004).

## Relationships Between Consumer Confidence and Purchasing Behavior

While post-assessment evaluations showed enhanced consumer confidence in the production of leafy greens, the campaign did not significantly affect consumer buying habits (Table 2). Post-campaign analyses indicate that the purchasing behavior among all respondents, regardless of age, were similar.

## People Perceive Fresh Produce Safety Differently

A series of paired Mann-Whitney two-sample tests reveal that for the sample as a whole, people perceive fresh produce safety differently (Table 3). For instance, respondents perceive "Overall Ag Awareness" and "Fresh Produce Safety Awareness" (p=0.071) and "Produce Confidence Level" and "Purchasing Behavior" (p=0.120) as being equally difficult to understand (Table 3). For all other resource pairs, there are statistically significant differences in the perception of fresh produce safety within a people that live in and around leafy green production (Table 3).

**Table 3.**

Paired Mann-Whitney Two-Sample Tests Used to Evaluate the Perception of Fresh Produce Safety Within a Rural Population Having Close Ties to the Production of Leafy Greens

	<b>Overall Ag Understanding</b>	<b>Fresh Produce Safety Awareness</b>	<b>Production Guideline Appreciation</b>	<b>Specific AZLGMA<sup>1</sup> Knowledge</b>	<b>Produce Confidence Level</b>	<b>Purchasing Behavior</b>
Overall Ag Understanding						
Fresh Produce Safety Awareness	0.62 <sup>2</sup> (0.071) <sup>3</sup>					
Production Guideline Appreciation	-0.76 (0.009)	-0.18 (0.219)				
Specific AZLGMA Knowledge	0.86 (0.034)	0.09 (0.241)	0.15 (0.265)			
Produce Confidence Level	0.36 (0.250)	1.02 (0.006)	1.31 (0.000)	1.25 (0.004)		
Purchasing Behavior	-0.23 (0.120)	-0.17 (0.000)	-0.41 (0.005)	-0.16 (0.009)	-0.86 (0.120)	

<sup>1</sup>The Arizona Leafy Greens Products Shipper Marketing Agreement

<sup>2</sup>Mean differences among matching pairs

<sup>3</sup>Mann-Whitney test p-value at the 0.05 level of statistical significance

## Implications

Although fewer YA became more knowledgeable about the AZLGMA by name, area residents appeared more sensitive to the new production standards. Results suggested that adults over the age of 35 years are more responsive to the needs of the produce industry than younger adults and that specific outreach programs that target a younger adult population would be beneficial to the produce industry.

While the overall confidence in leafy green production protocols improved during the study, there appeared to be a level of disconnect in the perception of production safety guidelines and public purchasing behaviors. In work presented here, people did not tend to associate minimizing risk in leafy green production practices to enhanced buying habits. This is similar to results shown by Perez and Howard (2007) in which consumers are motivated to minimize or at least reduce any expected negative utility (perceived risk) associated with purchase behaviors.

The effort reported here suggests that educational outreach and Extension programming involving specific food system issues that encourage public involvement can be effective within an agriculturally based community. As suggested by Jayaratne, Harrison, and Bales (2009), carefully reminding residents of their critical contribution in minimizing microbial risks could effectively mitigate their influences on production safety.

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