

Implementing Good Practices Programs to Encourage Production of High-Quality, Safer Produce in Mississippi

Abstract

Fifty-four growers/producers attended four 1-day good agricultural practices (GAP) and good handling practices (GHP) workshops at four locations in Mississippi. Pre- and postworkshop survey data indicated that the participants' food safety knowledge increased by 15%. Furthermore, the workshops helped producers develop their own food safety plans. The workshops also trained the producers to be prepared for U.S. Department of Agriculture (USDA) GAP and GHP audits. To assist producers in preparing for these audits, two mock audits were conducted after the workshops. As a result of the program, several producers became ready to be audited, and at least one producer became USDA GAP certified.

Barakat S. M. Mahmoud
Assistant
Research/Extension
Professor of Food
Science
Mississippi State
University
Pascagoula,
Mississippi
bm547@msstate.edu

Eric T. Stafne
Associate
Extension/Research
Professor—Fruit Crops
Mississippi State
University
Poplarville, Mississippi
eric.stafne@msstate.edu

Christine H. Coker
Associate
Research/Extension
Professor of Urban
Horticulture
Mississippi State
University
Biloxi, Mississippi
cec117@msstate.edu

Gary R. Bachman
Associate
Extension/Research
Professor of
Horticulture
Mississippi State
University
Biloxi, Mississippi
gary.bachman@msstate.edu

Nicole Bell
Food Safety and
Agribusiness Specialist
Alcorn State
University
Alcorn State,
Mississippi
nbell@alcorn.edu

Introduction

There is an increasing demand for fresh fruit and vegetables due to the health benefits associated with their consumption (Liu et al., 2000; Martin, Cherubini, Andres-Lacueva, Paniagua, & Joseph, 2002). However, fresh fruits and vegetables most often are grown in an open environment where there are multiple opportunities for exposure to microbiological and chemical hazards (Nayak, Tobin, Thomson, Radhakrishna, & LaBorde, 2015).

Recently, recalls and food-borne illness outbreaks linked to fresh fruits and vegetables have increased (Scallan, Hoekstra, & Angulo, 2011). Most of these outbreaks have been associated with microbial contamination, including from *Salmonella*, *Escherichia coli* O157:H7, *Listeria monocytogenes*, *Norovirus*, and *Hepatitis A virus* (Bowen,

Fry, Richards, & Beuchat, 2006). The U.S. Public Health Service estimates that 3,000 deaths and 48 million cases of diarrheal diseases occur in the United States each year due to pathogenic bacteria (Scallan et al., 2011). Preventing and controlling the contamination of fresh produce during production is the key to producing wholesome, healthful products (Cherry, 1999). Distributors of fresh produce are becoming more aware of the importance of safety issues and of programs such as the Good Agricultural Practices (GAP) and Good Handling Practices (GHP) audit program of the U.S. Department of Agriculture (USDA). As a result, they are demanding mandatory third-party independent audits of fresh produce producers as a prerequisite for purchase (Tobin, Thomson, LaBorde, & Bagdonis, 2011).

Purposes

The purposes of the workshop series described in this article were (a) to teach growers/producers and handlers how to reduce microbial risks during production, postharvest, handling, and distribution and (b) to educate producers on how to develop and implement farm food safety plans that prepare them for USDA GAP/GHP certification.

Methods

GAP/GHP workshop materials were developed according to the Food and Drug Administration (FDA)/USDA guidelines and a manual developed by the University of Maryland and the FDA (Rushing et al., 2010). Times and places for the workshops were advertised through flyers, blogs, social media, traditional press, and fruit and vegetable associations in Mississippi. Four 1-day GAP/GHP workshops were delivered in Biloxi, Hattiesburg, Jackson, and Starkville. The topics of the GAP/GHP workshop are shown in Table 1. Presented topics covered all steps at which produce can become contaminated, from production to marketing. Each topic was addressed via a 20- to 70-min PowerPoint presentation followed by a 5- to 10-min question-and-answer period.

Table 1.

GAP/GHP Workshop Topics and Time Allotted to Each Topic

Topic	Time (min)
Pretest	20
Introduction to GAP/GHP course/importance of food safety program	40
Site selection and soil	20
Agricultural water	20
Fertilizer use	20
Animal exclusion and pest control	20
Pesticide use	20
Worker health and hygiene	40
Traceability	20
Harvesting	20

Cooling	20
Produce cleaning and water treatment	40
Packing and storage	20
Transportation	20
Development of sanitation standard operating procedures	20
USDA audit verification checklist	70
Posttest and evaluation	20

Pre-and posttests were designed to assess the participants' knowledge about the subject first at the beginning and then the end of the series of workshops. The pretest and posttest each contained the 20 questions shown in Figure 1. The true/false format was used for these tests because it is easy to understand and less dependent on reading ability. Also, a simple evaluation form was developed (1 = *excellent*, 2 = *good*, 3 = *fair*, 4 = *poor*) and provided to participants to evaluate the materials and instructors (Figure 2). Furthermore, two mock audits were conducted at two program participants' farms after the workshop series.

Figure 1.

GAP and GHP Workshop Series Pretest/Posttest Questions (Answers Shown)

Question	True or False
The CDC estimates that each year roughly 1 in 4 Americans get sick from food-borne diseases.	F
After going to the restroom, farm workers should always wash their hands for 10 seconds.	F
Hand sanitizers are a substitute for proper handwashing.	F
First-aid kits do not need to be maintained unless someone gets hurt.	F
An organic fertilizer contains carbon.	T
The greatest potential source for contaminated water is groundwater.	F
Sunlight is a potential contamination source during harvest.	F
All animals are considered sources for contamination of fresh fruits and vegetables with pathogens.	T
Pests are not considered potential sources for contamination of fresh produce with pathogens.	F
The use of water in any form presents overriding concerns for food safety.	T
Diarrhea is a common symptom of food-borne diseases.	T
Traceability is the ability to link a product to its origin.	T

The USDA GAP/GHP program is a mandatory audit program.	F
Gloves are a substitute for proper handwashing.	F
Toilets must be accessible to personnel within 5,000 feet.	F
The three categories of hazards associated with fresh produce are biological, physiological, and chemical hazards.	F
A farm diagram is an invaluable reference for hazard analysis.	T
Knowledge and documentation of prior use of land is required to develop a farm food safety plan.	T
Iodine is the most widely used sanitizer for water treatment.	F
Producers can pass a USDA GAP/GHP third-party audit without records or documentation.	F

Figure 2.

GAP/GHP Workshop Series Evaluation Form

Subject/Instructor	Rating	Comments
Introduction to GAP/GHP course/importance of food safety program (Dr. Mahmoud)		
Site selection and soil (Dr. Bachman)		
Agricultural water (Dr. Stafne)		
Fertilizer use (Dr. Stafne)		
Animal exclusion and pest control (Dr. Coker)		
Pesticide use (Dr. Bachman)		
Worker health and hygiene (Dr. Mahmoud)		
Traceability (Dr. Mahmoud)		
Harvesting (Dr. Stafne)		
Cooling (Dr. Coker)		
Produce cleaning and water treatment (Dr. Mahmoud)		
Packing and storage (Dr. Bachman)		
Transportation (Dr. Mahmoud)		
Development of sanitation standard operating procedures (Dr. Coker)		
USDA audit verification checklist (Ms. Bell)		
Overall		

Please rate the subjects/instructors listed according to: 1, excellent; 2, good; 3, fair; and 4, poor.

Data were screened for missing or implausible values and then were analyzed through the use of SPSS 21.0 (IBM, Armonk, NY). A paired-samples *t*-test was conducted to assess differences between pre- and posttest variables. The a priori alpha level employed was 0.001.

Results and Discussion

The major concerns for food safety come from human feces, animal manures, other organic fertilizers, water, wildlife, and workers. Because fresh fruits and vegetables are often consumed raw, there is no absolute kill step, such as cooking, that ensures safe produce. Furthermore, there is no cleansing step that can remove all biological and chemical hazards (Harris et al., 2003; Scallan et al., 2011).

All of the 54 workshop participants were farmers/producers involved with the fruit and vegetable industry in Mississippi. Most of the participants (85%) were blueberry producers, whereas others produced melons, tomatoes, and other vegetable crops. A few participants were organic producers. A majority of the participants indicated that they had not attended GAP/GHP training before. Despite the fact that there were four workshop locations, the number of attendees was lower than expected, indicating that many farmers in Mississippi may not be aware of the importance of food safety programs because they are not mandated by federal and/or state regulatory agencies. However, in the near future, attending these programs will be mandatory for most farmers under the FDA Food Safety Modernization Act (FSMA).

We believe that these workshops strengthened the direct connection between Mississippi's fruit and vegetable growers and the Food Safety Extension education program at Mississippi State University. Most of the participants understood the importance of implementing GAP and GHP to reduce the risk of food-borne illness associated with fresh produce. Also, the workshops helped farmers reinforce their current food safety practices. Participants learned how to develop protocols to prevent microbial contamination during the production of fruits and vegetables on their farms. The evaluation survey, conducted after each workshop, indicated that growers were satisfied with the materials and the instructors.

The summary statistics from the trainings are presented in Table 2. Paired-samples *t*-tests were used to determine whether results differed between preworkshop and postworkshop responses. As a result of participating in the workshop, respondents improved their exam scores ($p < .001$). The results showed that the participants had some knowledge about food safety; however, their overall knowledge was significantly increased (by 15%) after the workshops.

Table 2.
Workshop Series Pretest/Posttest Results (\pm SEM)

Variable	Pretest		Posttest		Maximal score	<i>t</i> value	<i>p</i> value
	<i>N</i> ^a	<i>M</i> ^b	<i>N</i> ^a	<i>M</i> ^b			
Exam	50	14.44 \pm 0.28	50	17.36 \pm 0.21	20	-9.93	< 0.001

^aNumber of respondents who answered the question. ^bBased on the scale 1 = correct, 0

= incorrect.

Besides increasing producers' knowledge base, the workshop series also trained producers to be prepared for USDA GAP and GHP audits. Two mock audits were conducted at two program participants' farms after the workshop series to assess behavior changes and to assist these producers in preparing for USDA inspection. Several producers, with assistance from the program, became ready for an audit, and, at the time this article was written, one producer had become USDA GAP certified.

Furthermore, by following the GAP/GHP guidelines learned during the workshops, growers can improve product quality by reducing spoilage bacteria and increase product shelf life (allowing them to distribute to a wider range of markets), thereby increasing their income potential. The outcome of these workshops also could improve the Mississippi food supply, increasing consumer confidence in consuming local fresh fruits and vegetables.

As a continuation of the program, we are preparing FSMA produce safety workshops for growers in Mississippi to further prepare them for compliance with new federal regulations. Extension educators can replicate our GAP/GHP workshop program by following information provided at this link:

<http://srmec.uark.edu/Mahmoud10701.pdf>.

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