Good Agricultural Practices Certification for Small-Scale Produce Processors: A Case of Food Safety

Abstract

A case study illustrates both the process undertaken by a small produce-processing facility to become certified as having food safety good agricultural practices (GAP) and associated assistance provided by Extension. Information was collected from four U.S. Department of Agriculture Agricultural Marketing Service audits conducted over 2 years. The audits resulted in certification of the facility for processing southern peas and leafy greens at the Harmonized GAP with Global Markets Program Intermediate Level. The case study details the changes the facility implemented to become compliant with the requirements identified during the audits. It was concluded that broad and extensive Extension training and technical assistance could be needed to help small-scale processors become food safety GAP certified.

Barrett Vaughan
Assistant Professor and Extension Specialist
College of Agriculture, Environment, and Nutrition Sciences
Tuskegee University
Tuskegee, Alabama
btvaughan@mytu.tuskegee.edu

Demetrius Hooks
Assistant Manager
Al Hooks Produce
Shorter, Alabama
demetriushooks@yahoo.com

Miles Robinson
Program Director, Small Farm Rural Economic Development Center
College of Agriculture, Environment, and Nutrition Sciences
Tuskegee University
Tuskegee, Alabama
miles@mytu.tuskegee.edu

Introduction

The need for farmers to receive Extension education and training on good agricultural practices (GAP) related to produce food safety continues to increase as marketing opportunities expand and government regulations change. Concurrently, and perhaps consequently, the number of farms that obtain food safety GAP certification through third-party audits also has increased. In many cases, the need for certification is market driven—a situation that occurs when a commercial buyer prefers to or is required to purchase from certified farms to ensure that food is safe, and to avoid lawsuits. This requirement extends along the supply chain, and a buyer purchasing crops from certified farms likely will require that the intermediary postharvest operations (i.e., packers or processors) be similarly certified. This article presents an illustrative case study of the food safety GAP certification of a small-scale processing operation that supported the supply of produce from a group of small farms to a commercial buyer.

Background

The U.S. Department of Agriculture (USDA) Agricultural Marketing Service (AMS) (2015) describes the audit program for produce food safety as follows:

> Audit Programs offers [*sic*] voluntary independent audits of produce suppliers throughout the production and supply chain. Good Agricultural Practices (GAP) and Good Handling Practices (GHP) audits focus on best agricultural practices to verify that fruits and vegetables are produced, packed, handled, and stored in the safest manner possible to minimize risks of microbial food safety hazards . . . [adhering to] U.S. Food and Drug Administration . . . and industry recognized food safety practices. . . . In January 2002, USDA AMS formally implemented the USDA . . . GAP and GHP audit verification program . . . [and] incorporated the Produce GAPs Harmonized Food Safety Standard into its GAP and GHP audit program in 2011. The Produce GAPs Harmonization Initiative is an all-industry effort to harmonize GAP standards.

Regarding this "effort," the United Fresh Produce Association (2015) further clarifies the goal for producers:

> The goal . . . is "one audit by any credible third party, acceptable to all buyers . . ." [through] develop[ing] food safety [GAPs] standards and audit checklists for pre- and post-harvest operations, applicable to all fresh produce commodities, . . . on-farm operations and . . . regions . . ., and [making] them available . . . at no cost.

Literature Review

Addressing GAP for produce food safety has been an important area of Extension training and technical assistance for both farmers and farm workers. The standards for certification are high, and, necessarily, Extension activities have been adapted for a variety of audiences so that they are effective and lead to certification. For example, Tobin, Thomson, LaBorde, and Bagdonis (2011) developed a GAP training curriculum based on the results of a survey on the food safety policies of Pennsylvania commercial produce buyers. Their on-farm workshops increased growers' knowledge and confidence and led 20% of participants to plan to seek certification (Nayak, Tobin, Thomson, Radhakrishna, & LaBorde, 2015). Similarly, Kline, Kneen, Barrett, Kleinschmidt, and Doohan (2012) developed a food safety outreach program acceptable for Amish farmers that yielded positive outcomes. Vaughan et al. (2014) assisted over a dozen small-scale and limited-resource farmers in Alabama in becoming certified by undertaking an assortment of activities, including large- and small-group meetings, conference calls, and individual consultations. Mathiasen, Morley, Chapman, and Powell (2012) used a training video to improve agricultural workers' knowledge of food safety and found the approach to be significantly effective. With Iowa growers, Shaw, Strohbehn, Naeve, Domoto, and Wilson (2015) found that a 7-hour GAP course that combined traditional PowerPoint delivery with discussion improved knowledge and attitudes toward food safety.

Methods

The research discussed here was an illustrative case study. Becker et al. (n.d.) defined illustrative case studies as "primarily descriptive" and "typically utiliz[ing] one or two instances of an event to show what a situation is like" ("Types of Case Studies," para. 2). In the research discussed here, the case was a small produce-processing facility, and the event was the process of becoming food safety GAP certified. Information was collected related to

audit preparations, the audits themselves, postaudit briefings with the auditors, and the corrective actions needed. The audits were conducted in December 2012, July 2013, December 2013, and July 2014 by the Alabama Department of Agriculture and Industries for USDA AMS. Extension was continuously involved with the process through training and on-site technical assistance, mainly related to translation of the requirements into scale-specific, practicable changes.
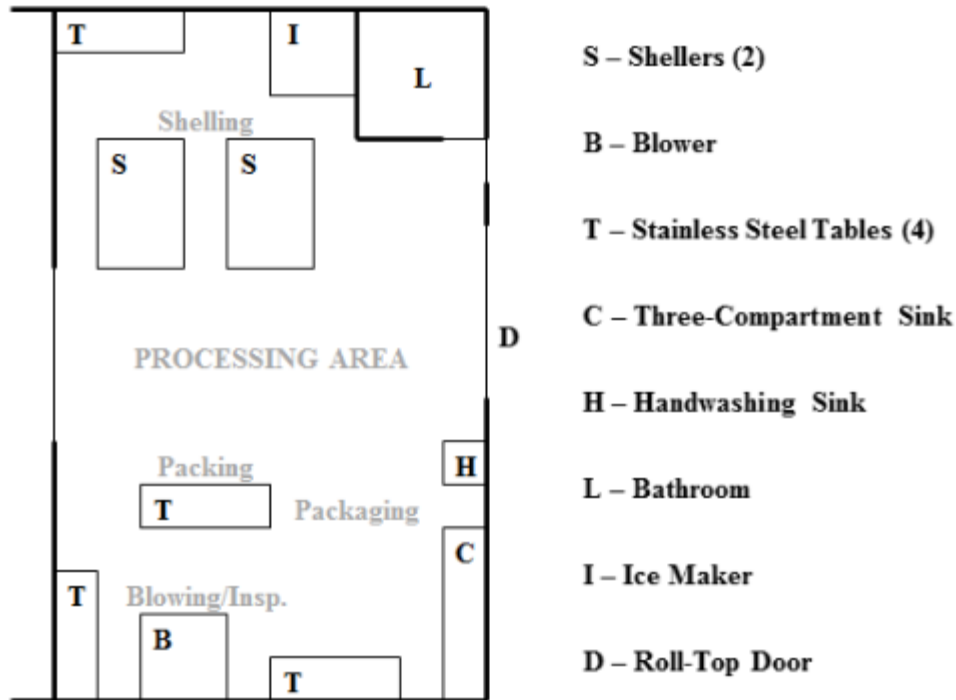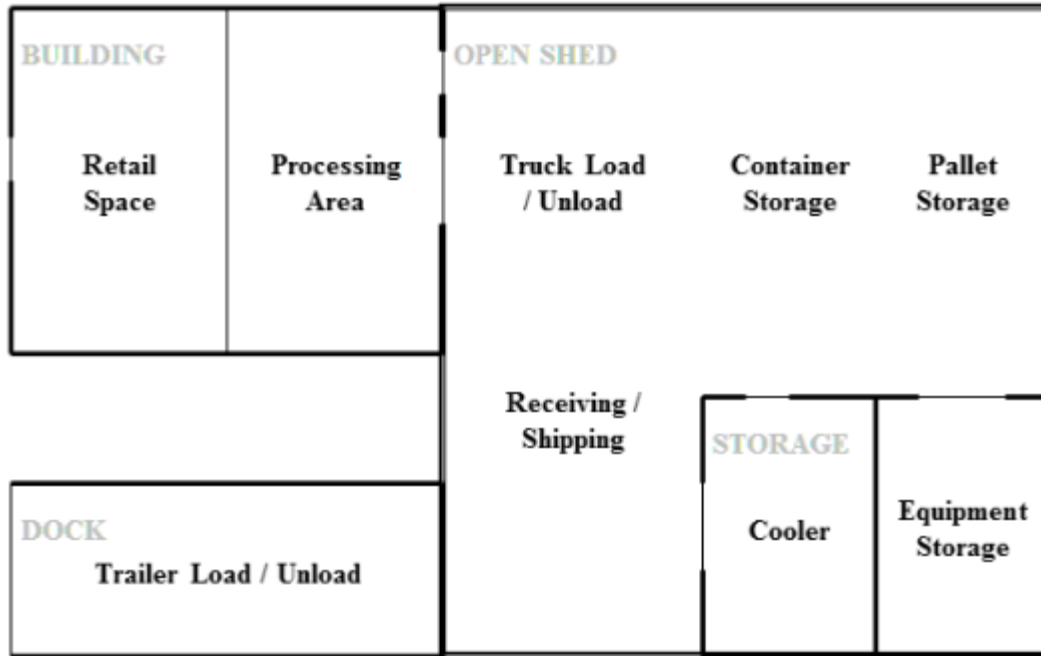
Description of the Processing Facility

Facility Specifications

The processing facility, located on a privately owned farm in south-central Alabama, has an area of 2,000 ft^2, divided into two equal sections. The front of the building serves as retail space; the rear of the building is the processing area. The processing area has a standard door and a roll-up doorway to a shipping and receiving area under a 5,000-ft^2 open shelter. The water and electrical supplies are from the county. The floor in the processing space is unfinished concrete with several floor drains. The processing space has a drop ceiling with smooth, washable tiles. The walls are also washable and have coved bases. There are two bathrooms, one in the retail space and one in the processing area. The processing area has a stainless steel, three-compartment sink and a handwashing sink and is equipped with an ice maker and stainless steel tables. The shipping and receiving area has a 20-by-30-ft cooler, a dock, an equipment storage shed, and a covered storage section for pallets and containers. Figure 1 shows the layout of the facility.

Figure 1.
Layout of Processing Facility

BUILDING

| Retail Space | Processing Area |

OPEN SHED

| Truck Load / Unload | Container Storage | Pallet Storage |

Receiving / Shipping

DOCK

Trailer Load / Unload

STORAGE

| Cooler | Equipment Storage |

PROCESSING AREA

T   I
          L
Shelling
S   S

Packing
T   Packaging
              H
Blowing/Insp.   C
T
B
          T

D

S – Shellers (2)

B – Blower

T – Stainless Steel Tables (4)

C – Three-Compartment Sink

H – Handwashing Sink

L – Bathroom

I – Ice Maker

D – Roll-Top Door

Staffing

The facility is staffed by up to a half dozen workers, mainly Spanish-speaking migrant workers, most of whom understand some English. The food safety training for the workers is supplied in Spanish and English.

Crops Processed

The crops handled at the processing facility include purple hull peas and leafy greens—specifically, collard, kale, mustard, and turnip greens—as well as other vegetables, such as tomatoes, peppers, squash, and onions. Most of

the crops are just inspected, packed, stored, and shipped; only a few are actually "processed" (i.e., washed, cut, or shelled) in the facility. Relative to the case discussed herein, the processing facility was GAP-certified for shelled purple hull peas and bundled, crated leafy greens. Inherently, the processing, or work flow, for each of these crops is specific, and the foregoing discussion will be limited to these two GAP-certified crops.

Processing Specifics

Peas

Purple hull peas are a "southern" pea, agronomically and gastronomically similar to black-eyed peas. The hulls, when mature, vary in size from 4 to 10 in. in length and ½ in. in diameter and in color from green with purple mottling to a mostly purple color. Purple hull peas are harvested from June to October.

Figure 2 depicts the work flow for processing peas. The peas arrive at the processing facility whole, in plastic mesh bushel bags. The peas are usually delivered in a refrigerated truck. On receiving, the bags are off-loaded onto pallets and stored in the cooler. A pallet can hold from 25 to 30 bushel bags of unshelled peas.

For processing, the peas are removed from the cooler and loaded into a sheller, which efficiently removes the hull from the edible peas inside. The sheller also removes any immature peas, stems, and other debris. The sheller can shell about 1 bu every 20 min. It can be used continuously for about 4 to 6 hr before it requires cleaning and maintenance. Only two shellers are used in the processing area due to space, personnel, and noise- and air-quality concerns.

The shelled peas are removed from the sheller and run through a blower as well as inspected by hand for the purpose of removing any pieces of hull or debris not removed by the sheller. The inspected, shelled peas are then packed into labeled containers (e.g., clamshells or zippered-closure, clear plastic bags). The label identifies the product, packer, and country of origin and has the item bar code. The containers are then placed by tens into reusable plastic containers (RPCs). RPCs are the ubiquitous black crates found in stores. The RPCs, or crates, are stacked on pallets and stored for shipping in the cooler. The peas are stored in the cooler at 37°F. For shipping, the stacked crates are wrapped with clear stretch wrap, and it is ensured that the vehicle is set to an acceptable temperature.

Figure 2.
Process Flow Diagram for Purple Hull Peas
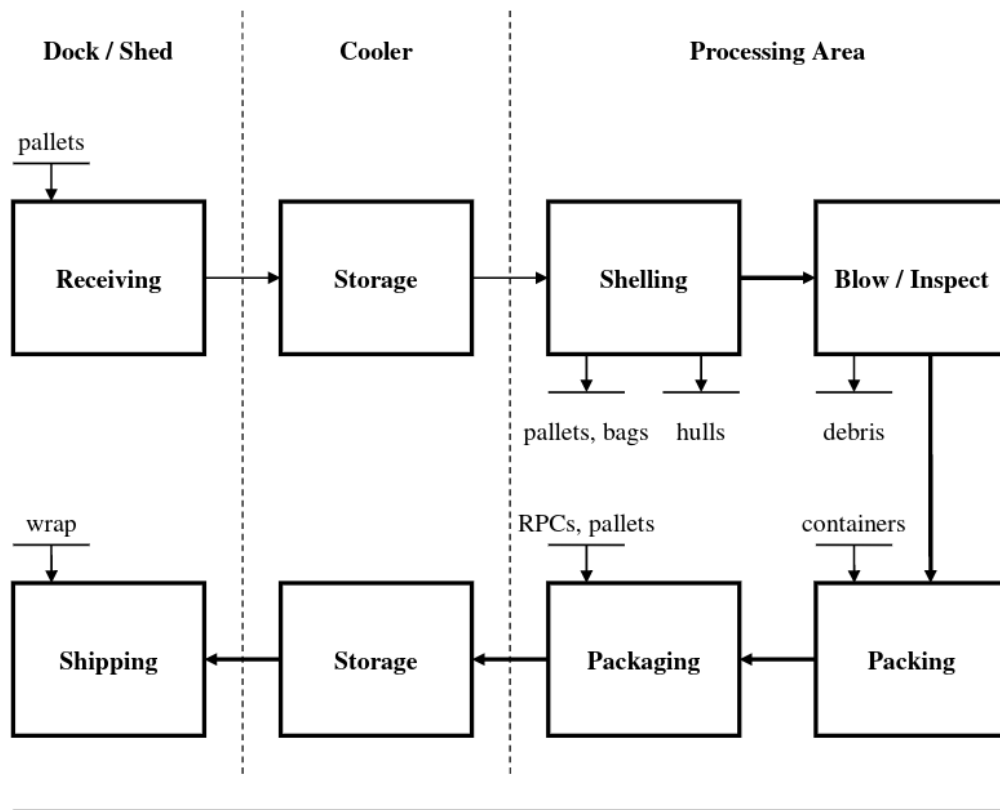
Note: RPCs are reusable plastic containers.

Leafy Greens

Leafy greens are a southern agricultural staple, and they range among varieties known to grow best in the cooler months. Collard greens, in particular, are a hearty, leafy green with large, smooth leaves and stems. Collard greens can be harvested from October to March.

Figure 3 depicts the work flow for processing collard greens. Collard greens are processed from November through early in the subsequent year. The collard greens arrive, usually by refrigerated truck, already bundled by a rubber band or twist-tie with the buyer's label attached and in RCPs (i.e., crates). The crates are off-loaded at the receiving area and stacked on a pallet. Each crate is first inspected for weight and quality before being topped with 1–2 lb of ice during stacking. The crates are stacked up to five or six levels high and stored in the cooler. Before storage or shipping, the stacks are wrapped with clear stretch wrap.

Figure 3.
Process Flow Diagram for Collard Greens
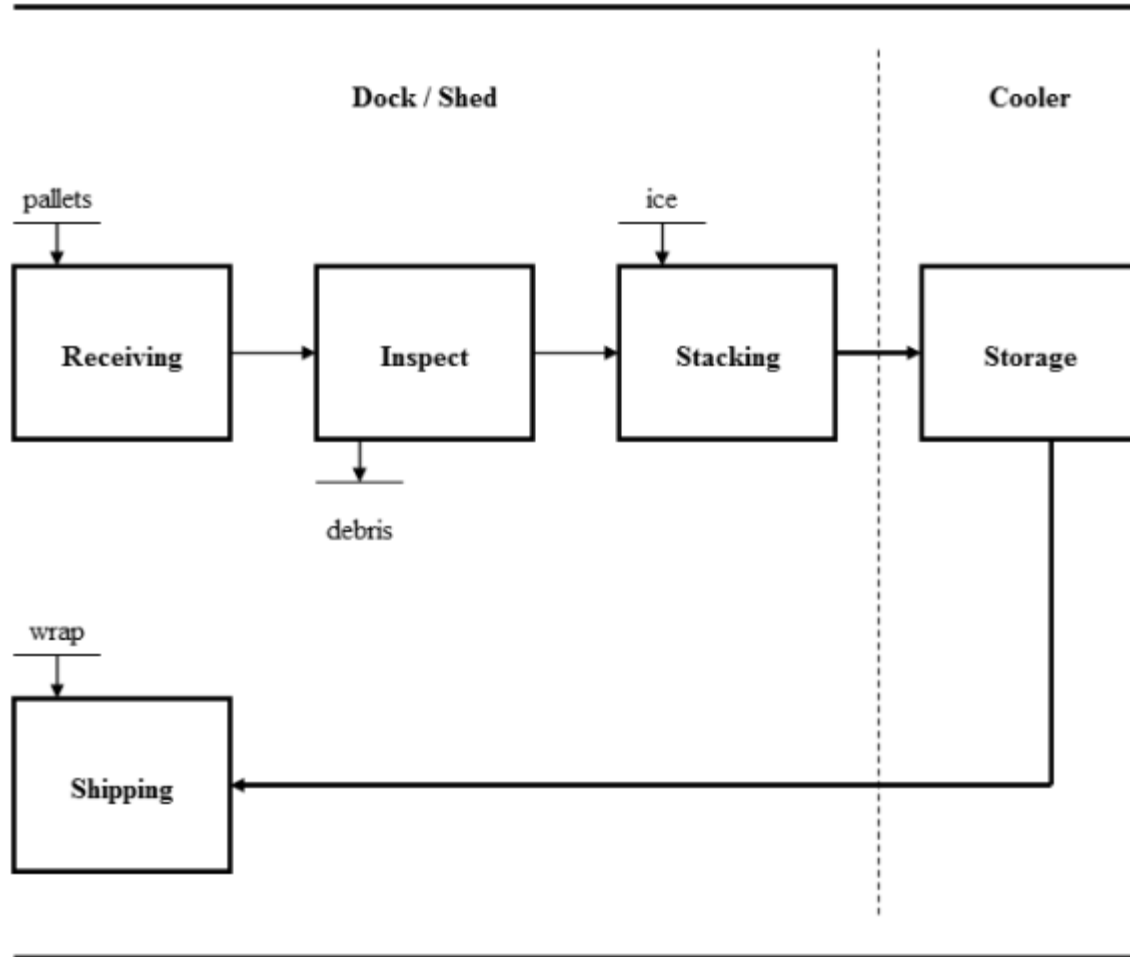
Results

GAP Certification

Since 2012, the processing facility has been certified for processing southern peas and leafy greens at the USDA AMS Produce Harmonized GAP with Global Markets Program Intermediate Level, which represents the most rigorous audit scheme offered by the USDA. The audit was comprehensive and addressed areas such as worker training, water quality, pest control, and facility maintenance. Becoming certified involved the facility's making numerous changes to typical practices—changes that were determined on the basis of requirements in the audit scheme. Extension rendered assistance to members of the facility's management team by helping them develop a complete and inclusive food safety plan that outlined procedures for making, reviewing, and evaluating the required changes. Required changes and associated Extension assistance pertained to two main areas: (a) personnel and record keeping (Tables 1 and 2) and (b) facilities, equipment, and handling (Tables 3 and 4).

Table 1.

Produce Harmonized GAP Requirements—Personnel and Record Keeping

Requirement area	Typical practice(s) before certification	Change(s) needed for certification per the food safety plan
Management responsibility	Management personnel shared responsibility	Personnel dedicated for food safety management

Food safety plan or risk assessment	No formal food safety plan established, general cleanliness	Food safety plan developed and reviewed
Raw material sourcing	Food safety certification not required for supplying farms	Food safety certification required for farms supplying produce to buyers that require certification
Documentation and record keeping	Record keeping informal and loosely organized	Record keeping on all required aspects of processing operation
Worker education and training	Training informal and as needed	Training formalized, uniform with industry, and required at hire and annually
Traceability	Mostly direct-to-consumer sales; some records kept for commercial sales	Developed lot numbers, labeling for containers and pallets, records for produce in and out
Recall program	Recall possible for most recent sales	Recall records, team, and procedures established and tested
Corrective actions	Actions taken as needed; general standard	Actions required and recorded; based on food safety standards
Self-audits	Review of practices as needed	Annual review of all food safety practices

Table 2.

Extension Assistance with Requirements—Personnel and Record Keeping

Requirement area: Change(s) needed for certification	Extension assistance rendered to facility management (time involved)
Management responsibility: Personnel dedicated for food safety management	Assisted with determining management roles and responsibilities (1 hr)
Food safety plan or risk assessment: Food safety plan developed and reviewed	Developed plan template (40 hr) Assisted with completing and reviewing plan (8 hr)
Raw material sourcing: Food safety certification required for farms supplying produce to buyers that require certification	Assisted with considering policy alternatives and helped develop policy (<1 hr)
Documentation and record keeping: Record keeping on all required aspects of processing operation	Developed and modified forms and records in template and as result of audit feedback (8 hr)
Worker education and training: Training	Trained managers on food safety (6 hr)

formalized, uniform with industry, and required at hire and annually	Trained employees on food safety (1 hr)
Traceability: Developed lot numbers, labeling for containers and pallets, records for produce in and out	Assisted with considering traceability labeling alternatives and with outlining procedures (4 hr) Developed printer label template (<1 hr)
Recall program: Recall records, team, and procedures established and tested	Assisted with establishing recall procedures (1 hr) Conducted mock recall exercise (1 hr)
Corrective actions: Actions required and recorded; based on food safety standards	Assisted with determining actions and timelines for responses to food safety issues and corresponding personnel decisions (<1 hr)
Self-audits: Annual review of all food safety practices	Assisted with conducting a comprehensive self-audit (4 hr)

Table 3.

Produce Harmonized GAP Requirements—Facilities, Equipment, and Handling

Requirement area	Typical practice(s) before certification	Change(s) needed for certification per the food safety plan
Agricultural chemicals/plant protection products	Chemicals stored where convenient	All chemicals labeled with dedicated storages areas
Water/ice	Municipal water used, a tested source	Water tests recorded; facility water system documented
Containers, bins	Containers stored where convenient	Containers stored to reduce risk of contamination and labeled
Facility, equipment, tools	Facility, equipment, and tools used with general cleanliness	Facility, equipment, and tools assessed for food safety risk and actions taken and recorded
Storage	Storage utilized with general cleanliness	Storage assessed for food safety risk and actions taken and recorded
Waste material	Wastes discarded as needed	Processing wastes and other wastes managed separately
Outside grounds	Cleaned as needed	Kept cleaned and mowed; trash bins maintained
Glass control	Lights in building were covered	Lights inside and outside of building and vehicles are checked

Leaks/lubricants	Problems addressed as needed; no formal plan	Records kept; spill procedures defined
Equipment and utensil construction	Wood, steel, aluminum, stainless steel, and plastic used	Stainless steel equipment and tables were purchased
Temporary repairs	Repairs completed as needed by usual standards	Repairs completed and recorded by food safety standards
Worker health/hygiene and toilet/handwashing facilities	Bathrooms available and cleaned regularly	Records kept of cleaning and stocking of required supplies
Temperature control	Temperature of cooler checked when entered	Temperature of cooler checked and calibrated and maintenance recorded
Packing and handling	Packing and handling with general cleanliness	Workers trained on food-safe packaging and handling
Pest and animal control	Pest control as needed	Professional pest and animal control at least monthly
Sampling/testing	Water sampling and testing not required, municipal source	Sampling procedures documented in plan
Packinghouse—water use on produce	Water from municipal source, not tested	Water tests recorded for ice maker source, municipal
Transportation—temperature control	Refrigerated vehicle typically used, temperature checked	Temperature checked and recorded for shipments
Transportation—equipment sanitation and maintenance	Vehicles checked for cleanliness	Records kept of vehicle condition

Table 4.

Extension Assistance with Requirements—Facilities, Equipment, and Handling

Requirement area: Change(s) needed for certification	Extension assistance rendered to facility management (time involved)
Agricultural chemicals/plant protection products: All chemicals labeled with dedicated storages areas	Assisted with identifying suitable storage for chemicals and appropriate labeling (<1 hr)
Water/ice: Water tests recorded; facility water system documented	Assisted with creating facility water system map (<1 hr)

Containers, bins: Containers stored to reduce risk of contamination and labeled	Assisted with determining appropriate container storage and handling (<1 hr)
Facility, equipment, tools: Facility, equipment, and tools assessed for food safety risk and actions taken and recorded	Assisted with inventorying and assessing food safety risks in facility and from equipment and tools (1 hr)
Storage: Storage assessed for food safety risk and actions taken and recorded	Assisted with assessing food safety risks from storage (<1 hr)
Waste material: Processing wastes and other wastes managed separately	Assisted with developing wastes management plan for processing and other wastes (1 hr)
Outside grounds: Kept cleaned and mowed; trash bins maintained	Inspected grounds and identified potential food safety risks (<1 hr)
Glass control: Lights inside and outside of building and vehicles are checked	Assisted with inventorying potential sources of broken glass/plastic and recommended replacements or procedure changes (<1 hr)
Leaks/lubricants: Records kept; spill procedures defined	Assisted with identifying risks of leakage and developing spill control procedures (1 hr)
Equipment and utensil construction: Stainless steel equipment and tables were purchased	Made recommendations for equipment upgrades (<1 hr)
Temporary repairs: Repairs completed and recorded by food safety standards	Assisted with developing repairs policies, time lines, and actions (<1 hr)
Worker health/hygiene and toilet/handwashing facilities: Records kept of cleaning and stocking of required supplies	Recommended procedures for cleaning record keeping (<1 hr)
Temperature control: Temperature of cooler checked and calibrated and maintenance recorded	Recommended procedures and equipment for cooler monitoring (<1 hr)
Packing and handling: Workers trained on food-safe packaging and handling	Provided training for workers (1 hr)
Pest and animal control: Professional pest and animal control at least monthly	Assisted with determining pest control needs and documentation requirements (<1 hr)
Sampling/testing: Sampling procedures documented in plan	Assisted with establishing procedures for sample collection and handling (< 1 hr)
Packinghouse—water use on produce: Water tests recorded for ice maker	Assisted with obtaining appropriate records from county water authority (1 hr)

source, municipal		
Transportation—temperature control: Temperature checked and recorded for shipments	Assisted with developing procedures for ensuring proper vehicle temperatures (<1 hr)	
Transportation—equipment sanitation and maintenance: Records kept of vehicle condition	Assisted with developing procedures for ensuring proper vehicle cleanliness (<1 hr)	

The requirements for the Produce Harmonized GAP with Global Markets Program Intermediate Level certification involved addressing the specific handling of crops, required a hazard analysis critical control points (HACCP) plan (or a written study of work flow addressing the potential for contamination), and required a plan for food defense. Additional changes were needed to meet these supplemental requirements (Table 5). Extension also rendered technical assistance to the management team in making these additional changes (Table 6).

Table 5.

Produce Harmonized GAP Global Markets Program Intermediate Level Requirements

Requirement area	Typical practice(s) before certification	Change(s) needed for certification per the food safety plan
Food safety plan and documentation		
Customer's food safety specifications	Food safety not required outside of general cleanliness	Processing under food safety specification required by customer
Risk assessment	Risks assessed by general cleanliness	Potential risks assessed according to process and food safety, measures to be taken in plan
HACCP plan or additional monitoring procedures	General cleanliness and attention to process steps	Additional monitoring procedures in place, similar to HACCP
Program for nonconforming product	Nonconforming products typically discarded	Actions regarding nonconforming products in plan, recorded
Corrective actions procedures	Addressed as needed by general standards	Required, recorded by food safety standards
Nonconformance and complaint record keeping	Addressed as needed by general standards	Actions required and recorded by food safety standards
Food safety incident procedures	Addressed as needed	Practices in place to address incidents, recorded
Approved supplier program	Purchases made where convenient	Suppliers recorded and information verified
Metal detection equipment, if utilized	Not utilized	Not required, may utilize in future
Food defense		

Threat assessment	General access control with signage	Potential threats assessed with food defense plan
Access control	Primarily signage	Signage, entry and exit recording, enforcement access restrictions
Sabotage evaluation measures	Determined as needed	Plan to detect sabotage, measures determined when detected, actions recorded

Note. GAP = good agricultural practices. HACCP = hazard analysis critical control points.

Table 6.

Extension Assistance with Produce Harmonized GAP Global Markets Program Intermediate Level Requirements

Requirement area: Change(s) needed for certification	Extension assistance rendered to facility management (time involved)
Food safety plan and documentation	
Customer's food safety specifications: Processing under food safety specification required by customer	Assisted with obtaining appropriate documentation from buyer (<1 hr)
Risk assessment: Potential risks assessed according to process and food safety, measures to be taken in plan	Assisted with identifying potential risks of contamination for each process through dialogue with management (2 hr)
HACCP plan or additional monitoring procedures: Additional monitoring procedures in place, similar to HACCP	Developed monitoring procedures for all processes and reviewed with management (2 hr)
Program for nonconforming product: Actions regarding nonconforming products in plan, recorded	Reviewed existing procedures for nonconforming product and recommended changes (<1 hr)
Corrective actions procedures: Required, recorded by food safety standards	Assisted with determining actions and time lines for responses to food safety issues and corresponding personnel decisions (<1 hr)
Nonconformance and complaint record keeping: Actions required and recorded by food safety standards	Assisted with determining actions and developing records for nonconformances and complaints (<1 hr)
Food safety incident procedures: Practices in place to address incidents, recorded	Assisted with determining actions and time lines for responses to food safety incidents (<1 hr)
Approved supplier program: Suppliers recorded and information verified	Assisted with developing procedures for reviewing suppliers and documenting verification (<1 hr)
Metal detection equipment, if utilized: Not required, may utilize in future	Assisted with consideration of use of metal detector and options (<1 hr)
Food defense	

Threat assessment: Potential threats assessed with food defense plan	Assisted with identifying potential threats (<1 hr)
Access control: Signage, entry and exit recording, enforcement access restrictions	Assisted with determining placement and wording of signage for access control (<1 hr)
Sabotage evaluation measures: Plan to detect sabotage, measures determined when detected, actions recorded	Assisted with developing appropriate sabotage evaluation measures and response plan (<1 hr)

Note. GAP = good agricultural practices. HACCP = hazard analysis critical control points.

There were, of course, expenses in obtaining food safety GAP certification. The general areas of expense, aside from the audit ($1,000–$2,000), were purchase or rental of new containers, labeling, transportation and storage, equipment upgrades (i.e., stainless steel), handling, water testing, and record keeping and management.

The audits for the facility have been successful, yet there were a few corrective actions needed regarding the water system, container storage, and records of pest control. Otherwise, the operation has been compliant in key areas, such as worker training, water quality, and traceability, which is a concept central to food safety GAP.
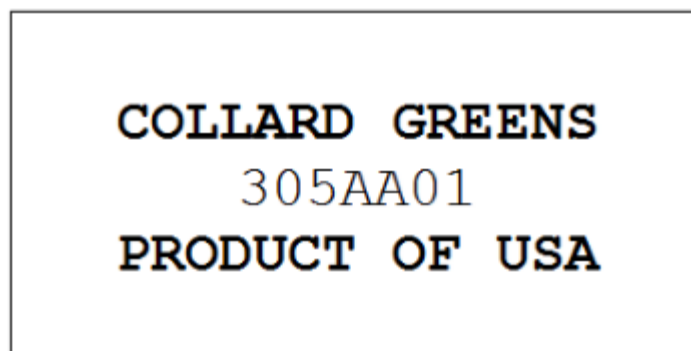
Traceability

Because of the importance of traceability to farm of origin, details of compliance in this area are included herein.

For the peas, each pallet of bags received is tagged with a farmer identification sheet, and each RPC shipped is labeled with the crop, the case quantity and container weight, the words "Product of USA," and a lot number that identifies the farm of origin. The lot number is a seven-digit number identifying the date of processing with the three-digit day of the year, the farm with a unique two-digit number, and the pallet with a two-digit number. The label is a commercially available 2-by-4-in. laser or inkjet printer shipping label (Figure 4).

For the leafy greens, each crate received is labeled at the farm with the crop, a lot number that identifies the farm of origin, and the words "Product of USA." The lot number is a seven-character code identifying the date of harvest with the three-digit day of the year, the farm with a unique two-letter code (the farmer's initials), and the field with a two-digit number. The label was a commercially available 2-by-4-in. laser or inkjet printer shipping label (Figure 4).

Figure 4.

Labels Used on Crates for Identification and Traceability to Farm of Origin

PEAS, Purple Hull /
10 ct - 16 oz
Product of USA
SFAC, Selma, AL 36701
213 01 01

COLLARD GREENS
305AA01
PRODUCT OF USA

Conclusion and Implications

The changes undertaken before and after the audits, with the assistance of Extension personnel, permitted the processing facility to achieve and maintain food safety GAP certification. Extension assistance included food safety materials development, manager and worker trainings, on-site facility evaluation, hours of one-on-one consultations with management, audit observation, and postaudit technical support (Tables 2, 4, and 6).

The main implication of the study is that broad and extensive Extension training and technical assistance may be necessary to assist small-scale processing operations with the process of food safety GAP certification. Extension technical assistance would involve observing and investigating the typical practices at the processing facility, deciphering the numerous and various requirements identified by the auditing organization, and, with the facility management, translating these requirements into needed changes through the development of a food safety plan.

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