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Agrosecurity Awareness Curriculum Design, Delivery and Evaluation with First Responders to Agricultural and Food Emergencies

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ABSTRACT

Disruption of agriculture and food systems, by intentional acts or through accidental introduction of diseases or contamination, would have devastating consequences. Heightened awareness and planning improves response, minimizing emergency impacts and shortening recovery time. This project was initiated to develop, implement and evaluate a curriculum to increase awareness and improve hazard recognition, thus improving emergency response. The curriculum includes eight modules, instructor resources and supplemental activities. Extension Agents trained in content and implementation helped conduct the training statewide. Program impact on awareness of issues and responsibilities was evaluated using 11 items and a 5-point Likert scale prior to and following the training. Participants (1,670) included firefighters, law enforcement, emergency management, wildlife and veterinary, and food industry sectors. Improvements in awareness ranged from 77% to 94% ($P < 0.01$). As a result of this training, 85% of participants planned to become familiar with local agriculture and food security emergency management and response systems; 87% planned to review responses to animal and plant disease outbreaks; 90% planned to become familiar with the Incident Command System; and 89% planned to examine emergency preparation in their communities. These results indicate the curriculum successfully increased agrosecurity awareness and could serve as a model for other states and/or countries initiating awareness level education as an important first step in recognizing and responding to potential threats. The diversity in professions of participants in this training indicates a need for a variety of training modules targeted to individual professions.

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INTRODUCTION

Agroterrorism has been defined as the intentional introduction of animal or plant pathogens; the intentional biological or chemical contamination of farm water supplies; the intentional adulteration of food or feed in the process from the farm to the table; the intentional misuse of a product meant for agricultural use such as pesticides, fertilizers, etc. for destructive purposes; and the intentional misuse of food and agricultural technology for illicit purposes *(7)*. The potential for terrorist attacks against agriculture and food systems has been recognized as a national security threat not only in the United States but in other nations as well. Results of such an attack could lead to economic crises, loss of confidence in a government's ability to protect its citizens and loss of lives *(5)*.

Food, agriculture and agribusinesses are an important part of Georgia's critical infrastructure. Georgia provides a substantial portion of the nation's food supply and the corresponding gross domestic product. It is the top United States producer of poultry meat and eggs, in addition to several crop commodities *(1)*.

Emergency Support Function (EFS) 11 of the U.S. National Response Framework includes measures related to controlling and eradicating highly contagious or economically devastating animal/zoonotic diseases or outbreaks of economically devastating plant pests and diseases *(2)*. The Georgia Emergency Operations Plan is a comprehensive plan to ensure mitigation and preparedness, appropriate response, and timely recovery from man-made, as well as natural disasters that may affect the residents of Georgia *(4)*. Under this plan, the Georgia Dept. of Agriculture, the University of Georgia College of Agricultural and Environmental Sciences and the Georgia Emergency Management Agency have collaborated to make efficient use of human and financial resources in improving capabilities to respond to an attack on the state's agricultural sector. This agrosecurity awareness curriculum development and training project was designed to increase awareness of, and ability to recognize, threats and vulnerabilities, to help manage these risks and to improve the reporting and diagnosing of suspected bioterrorism events, thus enhancing the preparedness of Georgia to face disasters, both natural and man-made.

The specific objectives of this project were to develop a state-specific curriculum that could be used by State Extension Specialists and County Extension Agents to:

- increase awareness of the economic impact of agriculture and food-related industries on the economy of the State of Georgia;
- increase awareness of potential events, both intentional and unintentional, that can have a devastating impact on agricultural and food-related income;
- increase awareness of the appropriate actions to take in the event of an emergency;
- increase awareness of the importance of the National Incident Command System *(3)* in dealing with agricultural and food emergencies; and
- increase awareness of the need for developing local systems and response teams for dealing with agricultural and food emergencies.

A second objective was to implement the agrosecurity awareness curriculum with first responders to agricultural and food emergencies and to evaluate its effectiveness in increasing the awareness levels of these responders about these types of emergencies.

METHODS

Protecting Georgia's Agriculture and Food, an agrosecurity textbook developed by Brown, Choueke, and Myers, *(1)* was used as the basis for curriculum development. The curriculum includes a CD-ROM with PowerPoint® slides for eight modules developed by content specialists and revised by outreach specialists into a format suitable for delivery to responders to food and agricultural emergencies. The topics included in the curriculum were an overall introduction to agrosecurity topics as outlined by Shutske *(6)*. Modules included the following topics:

- Introduction to agrosecurity (the need for agrosecurity awareness training
- Economic, Social and Environmental Impacts of Agroterrorism (economic data related to specific agricultural and food sectors within the state and the social, environmental and economic impacts of emergencies or disasters in those sectors)
- Animal Agriculture and Pathogens (recognizing signs of foreign animal diseases, using BUDDIES – an acronym for blisters, unusual ticks or maggots, deaths/downers, diarrhea, illnesses or abortions in high numbers, eating abnormality/ will not eat, staggering/strange neurological signs, including spasms)
- Plant Agriculture and Pathogens (recognizing symptoms of plant diseases, using the five D's – discolored, deformed, defoliated, dying, deficient)
- Food Industry in Georgia/ Risks and Threats (introduction to potential risks and vulnerabilities in food industries in Georgia)
- Agriculture and Food Emergency Management System (identification of appropriate responses to potential emergencies, including RAIN – recognize, avoid, isolate and notify)
- Chain of Events in an Emergency and Responsibilities in a Disaster (who to contact within the state of Georgia to report possible adverse situations and what to do until help arrives); and
- Summary and Next Steps (a summary of potential risks and possible actions to minimize adverse outcomes, steps needed in communities to become more adequately prepared to respond to emergencies, etc.)

All content modules were reviewed by Georgia Dept. of Agriculture and Georgia Emergency Management Agency personnel to ensure accuracy in such topics as identification of disease signs

TABLE 1. Audience categories attending agrosecurity awareness trainings

Category of Participants	Percentage of Audience (%)
Firefighters	21
Law enforcement	20
Emergency management personnel	15
Wildlife and conservation personnel	11
Agribusiness and agricultural personnel	9[a]
Health service related personnel	6
Veterinary personnel	5[a]
Department of Natural Resources personnel	3
Food industry personnel	2[a]
Poultry industry personnel	2[a]
Forestry related personnel	1
Volunteers	1
Agricultural research personnel	1[a]
Public works officials	1
Storage/warehousing personnel	1
Government officials	1

[a]Participants involved in agriculture and food-related industries

and symptoms, reporting of potential emergencies, appropriate actions to take until help arrives, etc.

An Instructor Manual was developed to provide step-by-step information to instructors on procedures to follow for the implementation and evaluation of the training, the specific script or dialogue for each module presentation, activities to include in classes to reinforce awareness education, and instructions and evaluation tools for assessing training impact. A Participant Manual was developed to provide participants with a print copy of the content being presented, as well as supplemental resources, such as lists of acronyms, useful websites to obtain content and training to help establish local infrastructure, and handouts to help identify and report potential emergency situations.

Georgia Extension Agents attended a two-day training session on background information related to the content. Agents who conducted pilot trainings in local communities received additional training on implementation and evaluation of the curriculum.

Agrosecurity Awareness Training opportunities were advertized statewide through the Georgia Emergency Management Agency, the Georgia Department of Agriculture and the University of Georgia Cooperative Extension. During the initial project period, trainings were conducted by Extension Agents and agrosecurity project personnel in approximately 50 locations statewide. Continuing education units (CEU) were made available from the Georgia Peace Officers Standards and Training Council; Georgia Firefighters Standards and Training; Georgia Department of Human Resources, Office of Emergency Medical Services; Georgia State Board of Veterinary Medicine; Pesticide Applicators Recertification and Certified Crop Advisor.

A retrospective pre and post-evaluation design was used to evaluate the impact of the program on participants' awareness about agrosecurity issues and responsibilities. This type of evaluation is useful in overcoming response shift bias in self-reports. When people gain awareness of a subject, they may realize their response on a pre-test was less accurate than they originally believed. According to Rockwell & Kohn *(6)*, retrospective pre and post "data collection instruments are relatively easy to develop, use, and analyze. Results are credible and indicate program impact even though the process seems backwards." The Cronbach reliability alpha of the 11-item instrument was 0.93. At the end of the program, participants were asked to record their level of awareness before and after the program for each of the 11 items on the instrument. Responses to these items were aggregated to obtain a value for general awareness about agrosecurity. Participants were asked to indicate whether or not they would take specific actions as a result of the training. Levels of satisfaction with the training were rated on a 5-point Likert scale ranging from 1 (not very helpful) to 5 (very helpful).

TABLE 2. Comparison of participants' agrosecurity awareness before and after the program

Participants' Awareness About:	Pre-test Mean	Post-test Mean	Significance Level	Percentage of Participants Whose Awareness Level Improved
1. Importance and vulnerability of agriculture and food and effects of potential terrorist acts	2.8	4.2	*P* = 0.01	82%
2. Need to participate in preparedness efforts to protect the state's agriculture and food	3.0	4.2	*P* = 0.01	77%
3. Who should be contacted in an agricultural emergency	2.6	4.2	*P* = 0.01	85%
4. Unusual clinical signs or "BUDDIES"[a] in animals that may indicate serious disease or agroterrorism	2.1	4.1	*P* = 0.01	91%
5. Need to inform local veterinarian immediately about unusual clinical signs in animals	2.6	4.3	*P* = 0.01	82%
6. Plant disease symptoms such as 5Ds[b]	1.8	4.0	*P* = 0.01	94%
7. Need to inform local Cooperative Extension Office immediately about plant disease symptoms[c]	2.2	4.1	*P* = 0.01	89%
8. Chain of events that occur when an agricultural incident is reported	2.1	4.1	*P* = 0.01	90%
9. Legislation and measures in place to help protect the food supply	2.1	4.0	*P* = 0.01	89%
10. Risk assessments, risk management and risk communication	2.3	4.1	*P* = 0.01	88%
11. Steps to take in my community when there is an emergency	2.7	4.2	*P* = 0.01	79%
General awareness about agrosecurity	26.1	45.4	*P* = 0.01	98%

[a]BUDDIES, an acronym for clinical signs of diseases in animals, stands for blisters, unusual ticks or maggots, death/downers, diarrhea, illnesses or abortions in high numbers, eating abnormality/will not eat and staggering/strange neurological signs, including spasms.

[b]The 5Ds of plant disease is an acronym for recognizing symptoms: discolored, deformed, defoliated, dying and deficient.

[c]Notification of County Extension Agents in the event of a suspected agricultural-related problem is an important step. In Georgia, agents can help notify the appropriate authorities and can take measures to help clients isolate conditions and avoid further spread of disease until the appropriate help arrives.

RESULTS

Participants who completed the Agrosecurity Awareness training program submitted 1,670 evaluations. There were participants from 131 of Georgia's 159 counties. The majority of the participants were firefighters and law enforcement personnel; however, 19% were directly involved in agriculture and food-related industries (Table 1). The comparison of pre- and post-training awareness data for each item indicates that the curriculum significantly increased the awareness of participants on each individual topic ($P = 0.01$) as well as improved their awareness in general about agrosecurity ($P = 0.01$), as summarized in Table 2. Mean scores of pre- and post-training awareness levels are presented in Fig. 1. Over 85% of participants indicated that

FIGURE 1. Comparison of participants' agrosecurity awareness before and after the program.

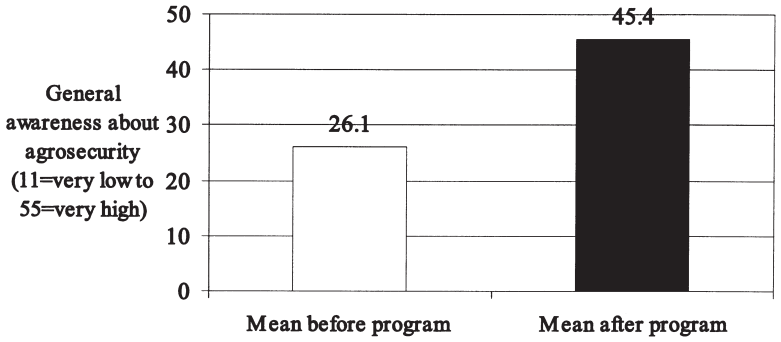
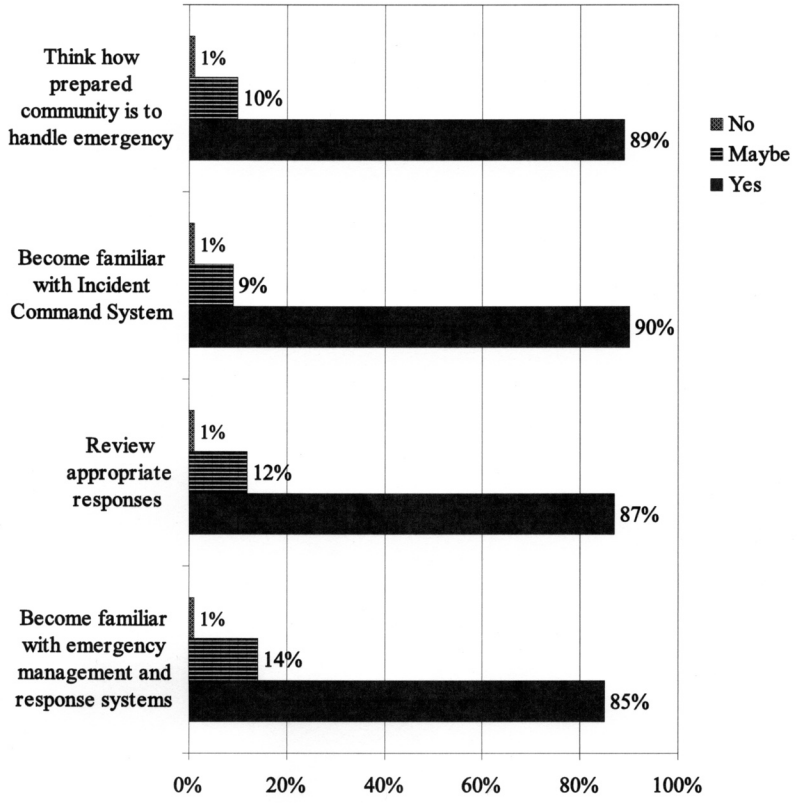


FIGURE 2. Action toward agrosecurity that participants plan to take as a result of participation in the training.



they plan to implement changes in each category as a result of the training they received (Fig. 2). Ninety-two (92) percent of participants rated the overall training as helpful to very helpful. Ratings for satisfaction for each content module are presented in Table 3.

CONCLUSIONS

This project was designed as an awareness level education initiative to introduce audiences to risks and vulnerabilities of the food and agricultural sectors. As such, the curriculum developed as a part of this project offered a broad introduction to a variety of topics. The limitation of such a project is that awareness does not necessarily translate into behavior change. However, it is an important first step in helping individuals recognize potential risks and identify appropriate authorities to notify and courses of action to take if a possible adverse event is suspected. Results indicated that the greatest improvements were seen in recognizing clinical signs of animal disease, in understanding the proper chain of events that should occur in the event of an agricultural emergency and in increasing overall awareness of agrosecurity.

Data from these sessions were used to revise the curriculum. The revisions include combining the animal and plant pathogen topics into one module and adding a CARVER + Shock Risk Assessment *(8)* activity to expand the food industry module. In addition, the modules have served as the basis for development of an on-line, password protected course on agrosecurity awareness. The broad range of occupations of those who attended these sessions indicates a wide interest in protecting agricultural and food systems and illustrates the need for more in-depth training on each topic targeted to specific audience sub-groups. Certain groups, such as food inspectors, manufacturers and food-service personnel, were underrepresented in the audience. This project can serve as a model for other states and/or nations interested in designing and conducting agrosecurity awareness training.

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TABLE 3. Participants' levels of satisfaction with the individual training modules

Training Session/Module	Percentage of the Participants Who Rated the Module as: Not helpful	Somewhat helpful	Very helpful	Mean	Standard Deviation
1. Economic, Social and Environmental Impacts of Agroterrorism	1%	21%	78%	2.8	0.4321
2. Animal Agriculture and Pathogens	1%	18%	81%	2.8	0.4154
3. Plant Agriculture and Pathogens	1%	22%	77%	2.8	0.4471
4. Food Industry in Georgia/Risks and Threats	1%	18%	81%	2.8	0.4073
5. Agriculture and Food Emergency Management System	1%	20%	79%	2.8	0.4296
6. Chain of Events in an Emergency and Responsibilities in a Disaster	1%	19%	80%	2.8	0.4241
7. Summary and Next Steps	1%	23%	76%	2.7	0.4580

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