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DairyBeef: Maximizing Quality and Profits— A Consistent Food Safety Message

D. A. Moore,[1] J. H. Kirk,[1] D. J. Klingborg,[1] F. Garry,[2] W. Wailes,[3] J. Dalton,[4] J. Busboom,[5] R. W. Sams,[6] M. Poe,[6] M. Payne,[6] J. Marchello,[7] M. Looper,[8] D. Falk,[4] and T. Wright[1]
[1]School of Veterinary Medicine, University of California, Davis 95616
[2]College of Veterinary Medicine, Colorado State University, Fort Collins 80523
[3]Department of Animal Sciences, Colorado State University, Fort Collins 80523
[4]Animal and Veterinary Science Department, University of Idaho, Caldwell 83607
[5]Department of Animal Sciences, Washington State University, Pullman 99164-6310
[6]Division of Agriculture and Natural Resources, University of California, Davis 95616
[7]Animal Sciences, University of Arizona, Tucson 85721
[8]Animal Resources Department, New Mexico State University, Las Cruces 88003

ABSTRACT

To respond to meat safety and quality issues in dairy market cattle, a collaborative project team for 7 western states was established to develop educational resources providing a consistent meat safety and quality message to dairy producers, farm advisors, and veterinarians. The team produced an educational website and CD-ROM course that included videos, narrated slide sets, and on-farm tools. The objectives of this course were: 1) to help producers and their advisors understand market cattle food safety and quality issues, 2) help maintain markets for these cows, and 3) help producers identify ways to improve the quality of dairy cattle going to slaughter. *DairyBeef: Maximizing Quality & Profits* consists of 6 sections, including 4 core segments. Successful completion of quizzes following each core segment is required for participants to receive a certificate of completion. A formative evaluation of the program revealed the necessity for minor content and technological changes with the web-based course. All evaluators considered the materials relevant to dairy producers. After editing, course availability was enabled in February, 2003. Between February and May, 2003, 21 individuals received certificates of completion.
(**Key words:** dairy cattle, food safety, meat quality)

Abbreviation key: DANR = Division of Agriculture and Natural Resources, University of California, **HACCP** = Hazard Analysis Critical Control Point, **MDBQAP** = Milk and Dairy Beef Quality Assurance Program.

INTRODUCTION

Dairy market cattle represent about 7% of the total beef production in the United States and can be valued at about 5% of a dairy's gross revenues (Roeber et al., 1999). In the western United States alone, over 800,000 dairy cows, worth about $500 million, are marketed to slaughter every year. Demands on meat packers as a result of Hazard Analysis Critical Control Point (**HACCP**) plan implementation have focused attention on the quality of incoming cattle (USDA:Food Safety and Inspection Service, 1996; Stefan, 1997; USDA:Food Safety Inspection Service, 1999a, 1999b). Turner (1997) suggested that the ability of producers to compete in local and world markets depends on the continued production of safe food. New on-farm programs to reduce residues and pathogen loads in market cattle must be developed and implemented by dairy producers to improve the quality of cattle going to slaughter.

Establishing the Need for Dairy Beef Education

In 1999, the US beef industry conducted an audit of quality defects in market cattle, including dairy cattle (Roeber et al., 1999). Quality defects cost about $70 for every cow or bull marketed that year, which was about 15% of the total cash return to the producer. Defects included 1.5% of cattle with residue violations, 7% with poor body condition (too fat or too thin), 13% with visible abscesses, and 25% with injection site lesions in the round. The major conclusions from the audit report were that dairy producers could improve the quality and value of their market cattle by managing to minimize defects and quality deficiencies, monitoring the health and condition of cows, and marketing cattle in a timely manner.

In 1998, the USDA Food Safety Inspection Service and the Livestock Conservation Institute conducted educational programs for producers, veterinarians, and

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Corresponding author: D. A. Moore; e-mail: dmoore@vmtrc.ucdavis.edu.

others on "Surviving in a HACCP World" which focused on reasons to adopt quality assurance programs to meet new demands by meat packers (USDA:Food Safety and Inspection Service, 1998). The programs included three 1-d lecture programs that set the background and established the need for protocols to decrease residues and pathogen loads in animals marketed for slaughter. Specific producer educational programs on current and emerging market cow issues, including strategies that can be implemented on the farm, are necessary for maintenance and development of the cull cow market.

In addition to educating producers, dairy advisors must be recruited to reinforce messages about food safety and quality and to help motivate and support change. The veterinarian's role in food safety has been widely discussed (Buntain, 1997; Fajt and Spire, 1997; Herrick, 1997). The food safety issues include: public health concerns over antibiotic residues in meat and milk; contamination of meat and milk by pathogenic bacteria such as *Listeria, Campylobacter, E. coli*, and *Salmonella* spp., and the possibility of transfer of resistance to human pathogens as a result of antimicrobial use in food animals. Consequently, food animal veterinarians often confront these issues because they serve as the livestock producers' primary resource for disease control, treatment, and information on management and health care decisions (Jordan and Fourdraine, 1993). Therefore, veterinarians are integral in the development of management decisions about on-farm food safety, but they need tools to broach the subject of on-farm food safety and a way to maintain producer interest. In a cooperative extension study of dairy producers using Total Quality Management for quality milk production and mastitis control, a follow-up study showed that producers found value with the program but desired continuous presence of an advisor or team to work with them and monitor their progress (Donaldson, 1998).

In a survey of dairy producers and opinion leaders in California, Payne et al. (1999) reported that 75% of respondents did not have, or were not sure that they had a written quality assurance program. Nearly 70% of surveyed producers with a quality assurance plan were using the Milk and Dairy Beef Quality Assurance (**MDBQAP**) 10-point plan, and 30% were using some other plan. Only 50% of producers with a quality assurance plan had veterinarian participation in the program, which is required by the 10-point plan. Although 99% of producers claimed that they were responsible for the safety of the beef coming from their farm, 57% knowingly sent sick cows to slaughter.

A previous survey of meat packers, dairy veterinarians, and government veterinarians conducted for the current project established the need for on-farm food safety education (Moore et al., 2000). Results of the survey revealed that meat packers considered the quality of incoming dairy market cattle as a control point for food safety hazards. More than 50% of dairy veterinarians and government-employed veterinarians believed that a current market for on-farm food safety services existed and more than 85% believed that a potential market would emerge. Veterinarians were more likely to express a strong interest in offering on-farm food safety services if they believed a current market existed. Although they saw a potential market for on-farm food safety services, veterinarians were somewhat unsure of their role in this area, emphasizing the need for education to motivate them in, and inform them of, their role in on-farm food safety.

Dairy cattle are marketed to slaughter differently than beef cattle. Therefore, education regarding dairy market cattle must be tailored for the dairy audience. Other dairy beef food safety and quality programs exist but have not been uniformly successful. The National MDBQAP was sponsored by the American Veterinary Medical Association and the National Milk Producers Federation and resulted in the development of booklet materials outlining a HACCP plan for residue reduction (Hentschl, 1992). However, the MDBQAP program was not widely implemented because it did not provide farm-specific tools to manage and monitor changes. Most producers did not see that they could have a residue problem. However, when an on-farm risk-assessment tool was used along with an educator or consultant, producers made specific management changes to reduce their risk of antibiotic residues in milk (Sischo et al., 1997). Thus, farm advisors, cooperative extension agents, and other dairy consultants are important for the provision and reinforcement of a consistent message. Although other dairy quality assurance programs have been developed and are useful, no program has yet addressed beef quality assurance for issues other than antibiotic residue avoidance.

In response to meat safety and quality issues in dairy market cattle, a 7-western state collaborative project was developed to create a distance-learning program for dairy producers, farm advisors, and dairy veterinarians that would provide a consistent message about dairy beef food safety and quality. The course objectives were to: 1) help dairy producers and their advisors understand market cattle food safety and quality issues, 2) help maintain markets for market cattle, and 3) help dairy producers identify ways to improve the quality of dairy cattle going to slaughter. The purpose of this paper is to describe the project, curriculum development, and formative and early test-participant evaluation results.

MATERIALS AND METHODS

Program Development and Design

The western United States has seen tremendous growth in cow numbers and average dairy herd size in the last 20 yr (USDA, 2003). Herds greater than 200 cows generally require hired labor, creating issues of communication and workforce training to insure correct medical treatments and avoid food safety problems, such as drug residues. Faculty from land grant universities in the western states with large dairy herds were recruited to the project based on location, expertise, and extension program focus so they could assist with developing program content, marketing, and education. The states represented in this collaborative project include Arizona, California, Colorado, Idaho, New Mexico, Oregon, and Washington and have over 25% of the nation's dairy cattle. The estimated number of dairy cattle marketed to slaughter from these states is over 800,000 cows per year.

The project targeted three audiences: dairy producers, farm advisors, and veterinarians. The potential participants in the west include approximately 400 dairy veterinarians and farm advisors, and over 3200 dairy producers, most with herds greater than 200 cows. The following learning objectives were adopted:

1. Identify market issues for dairy cattle going to slaughter.
2. Identify potential food safety hazards originating on the farm.
3. Use an algorithm to make culling decisions based on food safety, quality, and value-added potential.
4. Provide a format and materials for veterinarians and farm advisors to deliver a consistent message to producers about dairy beef food safety and quality.
5. Identify resources to develop on-farm food safety programs.

The course curriculum is given in Appendix A. Motivational and introductory materials were included as background, and not core material. The following 4 topics were considered core sections: reasons for cow condemnations, residue prevention, prevention of carcass defects, and reduction of biological risks. Each core segment consisted of a video or narrated slide set, ranging from 5 to 20 min in length, and a quiz. These core segments represent the various "hazards" (biological, physical, and chemical) that may be found in cattle going to slaughter, and represent the major reasons for condemnation, or meat safety and quality problems (Roeber et al., 1999; Roeber et al., 2002). Successful completion of a quiz following each core section is required for participants to receive a certificate of completion.

Three videos were produced: *Virtual Tour of the Packing Plant, Interview With a Packer*, and *Residue Prevention*. Each video began with a script or list of questions. Scripts were reviewed by content experts and video production staff before taping. Broadcast quality recordings were made at several locations in California. Taped segments were digitized and edited using standard professional nonlinear digital video editing methods. Full television screen programs were produced and field-tested for effectiveness. Once the content was approved, streaming media versions were produced for the website and CD-ROM. Each slide set was developed by a content expert and reviewed by the development team. A script was developed for each slide set so that a narrator could provide all the information in a voice-over. The narrated slide sets are delivered online as a video.

Online extension education for dairy audiences has been highlighted as a means of providing more information with fewer extension education resources (Hutjens and Baltz, 2000). Internet access for our audiences could be considered a challenge, but according to the National Telecommunication and Information Administration, about 54% of American households are using the Internet (National Telecommunications and Information Administration, 2003). Successful adult educational programs motivate participant change by overcoming obstacles to participation, enabling change, and reinforcing the change (Green and Kreuter, 1991). Online education technologies can be used in all of these stages of behavior change. Multiple methods of program delivery were chosen for *DairyBeef*; the Internet, through a web-based course that provides modular programs and flexibility, and a CD-ROM, with the same course content but allowing use in a classroom setting. Production of the *DairyBeef* website and CD-ROM version of the course required technical assistance from a web-designer and media experts. The University of California, Division of Agriculture and Natural Resources (**DANR**) Communication Services served as a comprehensive communication support entity that provided extensive production support for the *DairyBeef* project.

The website (http://dairybeef.ucdavis.edu) was designed with 7 concepts in mind: 1) allow participants to locate the topics easily through a well-organized site; 2) use a variety of media to maintain interest; 3) allow access to all parts of the program, including streaming video, by providing links to media software; 4) allow users to choose topics whenever they wanted by modularizing the course; 5) provide an interactive way for participants to test their knowledge of specific core material; 6) provide access to on-farm tools and more detailed web information; and 7) be able to capture infor-

mation from registrants on quiz scores, discussion questions, and evaluations.

The project team decided that the program would encourage but not require individuals to register to view program materials. For those serious enough to desire a course certificate, we would be able to capture some information about them when they registered. The only motivation for completing course materials would be the certificate of completion. A survey tool software program written in ColdFusion (http://www.macromedia.com/software/coldfusion/) by DANR Communication Services staff was used to develop the registration form, quizzes, and evaluation form. The software also helps to manage data generated from the forms by capturing each online submission and converting data to a spreadsheet format for subsequent analysis.

The CD-ROM version of the program was designed so that a veterinarian or farm advisor could provide the course in a classroom setting. The CD-ROM includes notes for the trainer on program advertising, registration, system requirements, software needs, computer-file names of educational segments, quizzes, a course evaluation form, and information on the principles of adult learning. The slide set segments can be delivered either with the given narration or with a printable script used by the trainer.

Evaluation

Once the program content was established and educational components produced, the course was placed online. To facilitate improvement of course materials and delivery, an advisory committee was established to conduct a formative evaluation of the content and design of the web-based program. A list of 41 potential advisory committee members was generated from the California Dairy Quality Assurance committee member list and from nominations by project collaborators. These individuals were provided an electronic mail cover letter, an offer of an honorarium, a link to the website, and a multiple-choice evaluation survey that asked specific questions about content, graphics and media, navigation and user interface, overall impressions, demographic information, and open-ended questions about each of the course segments.

Formative evaluation results were used to modify program materials where necessary. After modifications, the website and CD-ROM based course were marketed by brochures distributed at two producer events, the International Agricultural Exposition in Tulare, CA, and the Western Dairy Management Conference, Reno, NV. A brochure was mailed to approximately 1100 individuals on a mailing list of producers, farm advisors, and veterinarians who were invited to visit the website or participate in a classroom training program. Course delivery method (website or classroom program) was at the discretion of individual state collaborators and extension educators.

To evaluate the course, participants were requested to complete all quizzes and the course evaluation to receive a certificate of completion. The registration form and quizzes were submitted online and stored on a DANR computer server. The individual's e-mail address served as the link and personal identifier for the registration form and collection of quizzes so that upon passing all, the participant would receive a certificate in the mail. An electronic message was sent to the project director each time a participant submitted a registration form, a discussion question response, a quiz, or an evaluation. Discussion questions (Appendix B) on the Web site were provided to give web participants an opportunity to comment on issues qualitatively. Answers to discussion questions were not required to obtain a certificate.

RESULTS AND DISCUSSION

Formative Evaluation

A formative evaluation is a means to identify strengths and weaknesses, content problems, and clarity issues (Patton, 1996), and in this web-based, media-intensive program included: the images, site navigation, and overall delivery method. A formative evaluation can improve any new or pilot program (Brown and Kiernan, 1998). In the Web site formative evaluation, 20 individuals reviewed the course materials and completed the quizzes and formative evaluation survey. The advisory committee consisted of 1 dairy producer, 6 cooperative extension specialists, 2 milk cooperative employees, 8 dairy veterinarians, 2 county farm advisors, and 1 veterinary school faculty member. Fifty percent had previously taken a Web-based course.

All evaluators agreed that the subject matter was relevant to dairy producers and that the program would enhance producers' knowledge about market cattle quality and safety (Table 1). A few individuals experienced difficulty with navigation and program downloading time. Comments on slow downloading time for videos and some navigational issues due to computer specifications and type of Internet access were crucial to improve program access. The production team corrected problems by using new video streaming software and minor redesigns of the different segment links.

Course Delivery and Evaluation

Between February and May, 2003, 27 individuals registered for the course on the Web site and 14 partici-

Table 1. Advisory committee responses (n = 20) to a formative evaluation survey on *DairyBeef: Maximizing Quality & Profits* web-course for dairy producers.

Content	Strongly agree	Agree	Disagree	Strongly disagree
Subject matter is relevant to dairy producers	19	1	0	0
At least 60% of dairy producers will make a change in their operation.	3	13	4	0
Subject matter will enhance producer's knowledge about meat quality & safety	17	3	0	0
Graphics and media				
Use of different media serves a clear purpose	14	5	1	0
The web pages are "friendly" and engaging.	6	14	0	0
Navigation				
I was able to control the rate of presentation of subject matter.	9	7	2	2
The interactivity is well-designed to increase the program's value.	7	13	0	0
Well organized for ease of use	12	8	0	0
Program loading was rapid	5	11	2	2
Overall Impressions				
I would suggest this courseware to dairy producers	14	6	0	0
Effective way for producers to understand food safety issues	11	9	0	0
Distance education compares favorably with other means of education	10	9	1	0

pated in the course in a classroom setting (Table 2). More than 50% of participants were dairy producers from California. Five of the website participants and 12 of the classroom participants completed the course evaluation. When asked if they were likely to make changes, most participants responded that they were likely to assess the health and condition of cattle before sending to slaughter, assign one person to determine drug withdrawal times are met before slaughter, assess the farm for physical separation of chemical storage from feedstuffs, review drug labels, and assure that all injectable drugs and vaccines are given in the neck (Table 3). However, some producers were still likely to send a cow with a fever or lymphoma to slaughter.

Discussion questions were submitted anonymously and were not required for certification. Of the 27 web registrants, 7 completed Discussion Section 1 (not in a core segment), 6 completed Discussion Section 2, 3 completed Discussion Section 3, and one completed Discussion Section 4. In response to the first set of discussion questions, "What do you think a dairy producer's role is in meat safety?" and "What kinds of things can producers do to provide quality market cows?" Common response themes were: "A dairy producer's role in meat safety is to provide a quality product, an extension ... and result of producing quality milk. Cows that are treated well not only produce the desired product, milk, but when their usefulness as milk producers diminishes, the healthy cow becomes a good source of meat" and "Market cows of proper body condition without drug residue." Discussion Question 2 was: "What things do you think you could do on your farm to help prevent condemnations at slaughter?" The general theme revolved around "Not using the slaughterhouse to dispose of dying cattle."

Participants completing one program segment and quiz were likely to continue to submit quiz results. Seven individuals completed all of the quizzes on the Web site. All classroom participants submitted quiz results. For Web site submissions, 7 of 9 passed Quiz 1 (Cow Condemnations) the first time, 6 of 8 passed Quiz 2 (Residues) the first time, 5 of 7 passed Quiz 3 (Carcass Defects) the first time, and all 7 passed Quiz 4 (Biological Risks) the first time. For classroom participants, 12

Table 2. Characteristics of *DairyBeef: Maximizing Quality & Profits* course registrants[1] February through May, 2003.

Occupation	Number	State	Number
Dairy owner/manager	20	California	21
Extension educator	4	Colorado	6
Veterinarian	4	Idaho	2
Herdsman	3	Minnesota	1
Calf raiser	2	Ohio	1
Agriculture teacher	1	Pennsylvania	3
Dairy cooperative	1	Texas	1
Other	6	Washington	1
		Unknown or country other than US	5

[1]27 participated online and 14 participated in classroom courses.

Table 3. Participant evaluation[1] of the *DairyBeef: Maximizing Quality & Profits* educational program between February, 2003, and May, 2003.

Content	Strongly agree	Agree	Disagree	Strongly disagree
Subject matter is relevant to my dairy operation	13	4	0	0
I will be making at least one change to enhance food safety & market cow quality.	6	8	1	0
Subject matter enhanced my knowledge about meat quality & safety in market cows	7	10	0	0
As a dairy producer, I am in the meat and milk food business	13	4	0	0
How likely are you to do the following on your farm?	Very likely	Somewhat likely	Not likely	No answer
Send a cow with a fever >103.5 to slaughter	2	8	5	2
Assess health and condition of cow before sending to slaughter	14	1	0	2
Assign one person to determine drug withdrawal times are met before slaughter	14	1	0	2
Assess farm for physical separation of chemical storage from feedstuffs	13	2	1	1
Review drug label directions with person(s) administering drugs to cows on the farm	13	2	0	2
Assure all injectable drugs and vaccines are given in the neck	10	5	0	2
Send a cow with lymphoma to slaughter	1	9	5	2
Graphics and Media	Strongly agree	Agree	Disagree	Strongly disagree
Use of different media serves a clear purpose	12	4	1	0
Screen design and layouts were clear, uncluttered and well-organized	9	7	0	0
Overall impressions				
I would recommend this course to others	12	3	0	0
	Yes	No	No opinion	
I believe this course should be available in Spanish	11	2	2	

[1]Course evaluation was suggested but not required for certification. All evaluations were completed anonymously. Five individuals completed online evaluations and 12 completed classroom course evaluations.

of 14 passed Quiz 1 the first time, 10 of 14 passed Quiz 2 the first time, 11 of 14 passed Quiz 3 the first time, and 10 of 14 passed Quiz 4 the first time. The overall first time pass rates for all quizzes combined were not different between the 2 groups: 80% for the Web site participants and 77% for the classroom participants ($P = 0.48$).

CONCLUSIONS

DairyBeef: Maximizing Quality and Profits (http://dairybeef.ucdavis.edu) is a modular, distance learning program that focuses on improving the quality, increasing the profitability, and maintaining the integrity of dairy cattle going to slaughter. The program provides a consistent message across the dairy industry and is available both in Web site format and CD-ROM. A formative evaluation with 20 advisors provided critical information for minor modification of content and Web site downloading and navigational issues. Evaluators agreed the subject was relevant and would recommend the site to producers. Marketing an educational program of this type is the biggest challenge to educators. In the first 4 mo online, 27 individuals registered for the course. A course evaluation (preliminary data of online and classroom participants) indicated that although most participants found the course relevant and enhanced their knowledge, some producers were still likely to market a cow with a fever or lymphoma to slaughter. Although educational programs may provide awareness, information, and even tools, there are still many barriers to changing individual behavior.

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APPENDIX A

Program Outline for *DairyBeef: Maximizing Quality & Profits Web Site*[1] CD-ROM Program for Dairy Producers, Farm Advisors, and Veterinarians

Section One (estimated time to complete: 35 minutes)
Reasons for you to participate
Mr. Food *Video*
Interview with a Packer *Video*
Virtual Tour of a Packing Plant *Video*
Introduction to HACCP *Slide set*
Discussion
Section Two (estimated time to complete: 15 minutes)[2]
Why Was My Cow Condemned? *Slide set*
Discussion & Quiz
Section Three (estimated time to complete: 20 minutes)[2]
Residue Prevention *Video*
Discussion & Quiz
Section Four (estimated time to complete: 20 minutes)[2]
Preventing Carcass Defects *Slide set*
Discussion & Quiz
Section Five (estimated time to complete: 30 minutes)
Reducing Biological Risks from Market Cows *Slide set*[2]
Quiz
Prudent Antibiotic Use on Dairies *Slide set*
Section Six (estimated time to complete: 15 minutes)
Improving Cow Carcass Quality for Slaughter *Slide set*
A Decision Tree for Sending Cows to Slaughter *Interactive online*
Section Seven (estimated time to complete: 15 minutes)
Program Wrap-Up
Course Evaluation

[1]http://dairybeef.ucdavis.edu.
[2]Indicates core segment of the curriculum required to receive a certificate.

APPENDIX B

DairyBeef Web Site Discussion Questions

Section 1.
What do you think a dairy producer's role is in meat safety?
What kinds of things can producers do to provide quality market cows?
Section 2.
What things do you think you could do on your farm to help prevent condemnations at slaughter?
Section 3.
What new things did you learn about antibiotic residue prevention?
What do you think is the most important cause of a residue showing up in a dairy producer's bulk tank?
Section 4.
What kind of incentives would most dairy producers need to give injections in the neck region?