

Drug Use Survey and Evaluation of Quality Assurance Training for Meat Goat Producers

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ABSTRACT

A meat goat quality assurance training program was developed and tested in seven groups of meat goat producers in North Carolina. The program focused on drug use and residue avoidance. A written test on quality assurance was administered before and after the individuals participated in the program. Significant increases ($P < 0.0001$) were found in test scores for 348 individuals completing both tests. Just before the start of each training program, a subset of 113 producers completed surveys designed to determine their sources of animal drugs and knowledge about withholding times following use of those drugs. Producers most commonly sought animal health information from multiple sources and most frequently obtained animal drugs from the feed store. Most producers stated that they understood what a withholding period was and that they

were aware of the withholding times for the drugs they used. Over one-third of the producers indicated that they commonly used a veterinarian. Producers attending the programs increased their apparent knowledge of meat goat quality assurance and demonstrated a reasonable awareness of drug use regulations based on the survey results.

INTRODUCTION

American consumers consider the safety and quality of the food they consume to be a major priority. Consumers deserve and expect high-quality, wholesome, and safe products from the food-producing animal industries. To address these expectations, quality assurance programs have been developed by several of these industries. Examples include the Pork Quality Assurance Program,¹ the Milk & Dairy Beef Quality Assurance Program,² and the Beef Quality Assurance Program.³ The Pork Quality Assurance Program¹ focuses on good management practices in the handling and use of

animal health products and a review of herd health programs. The Milk and Dairy Beef Quality Assurance Program was designed to reduce the occurrence of violative drug residues in milk and dairy beef by providing education to producers about appropriate management and drug use techniques.² The National Cattlemen's Beef Association provides Beef Quality Assurance National Guidelines³ that include consideration of feedstuffs, feed additives and medications, processing/treatment and records, injectable animal health products, and care and husbandry practices. The American Veterinary Medical Association has developed educational materials about veterinary therapeutics as well as judicious use of antimicrobials and veterinary biologics.⁴⁻⁶

Despite the strong interest and rapid growth of the meat goat industry in the United States, the authors were not aware of a quality assurance program directly focused on meat goats that had been producer-evaluated. A quality assurance program for meat goats is important because many goats are slaughtered privately and marketed without inspection and it has been reported that goat meat has a higher ante- and post-mortem condemnation rate than other livestock species.⁷ However, data provided by the Food Safety and Inspection Service indicate that in recent years condemnation rates for goats are approximately equivalent to those for other animals.⁸

North Carolina and other states have rapidly developing meat goat industries. In 2001, the Franklin County Goat Producers Cooperative was formed in Franklin County, NC. This group was expanded to include the entire state and was renamed the North Carolina Meat Goat Producers Cooperative in February of 2003. This cooperative brought together individuals interested in raising meat goats and, ultimately, selling goats for meat purposes. As the organization developed, the need for a quality assurance program for producers became evident. In 2001, the Association decided to initiate a certification program, in which only "certified" producers would be allowed to sell

goats for meat through the organization. A certification training program was developed that addressed proper drug use and residue avoidance as well as recommended management practices for meat goats.

The purpose of this study was to assess the apparent impact of the training program on attendees by comparing performance on an examination given before and after the training program. A secondary purpose was to survey producers prior to the training sessions to collect information on producers' opinions on and knowledge of drug use and to determine their sources for animal drugs and related information.

MATERIALS AND METHODS

Certification program and materials

Certification programs were 1-day training sessions, each lasting approximately 6 hours. A total of seven training sessions held during 2001 to 2003 are reported. For these seven sessions, 384 attendees took the tests, with 348 completing both tests before and after the program.

Materials were developed for an oral presentation and a handout (available upon request from the author). Topics included reasons for producing safe and wholesome high-quality products; essentials of quality assurance/product safety programs; steps for preventing drug residues; feeding management; sanitation; herd health with focus on correct use of drugs and biologics; drug labeling and approval processes by the Food and Drug Administration (FDA); extra-label drug use; and requirements for and definition of a client-veterinarian-patient relationship; proper injection techniques and sites; record-keeping; selecting, using and storing vaccines; proper use of animal health products; and administering health care products to goats. The oral presentation was given using overheads and/or other appropriate audio-visual aids.

Many other topics were presented during the training program, including North Carolina meat standards and quality, grading goats (with a live demonstration), selection

of breeding stock, scrapie certification program updates, and nutrition with an emphasis on forages. A detailed notebook was given, providing considerable information on basic goat facts, health issues, and related health and management topics.

Testing

Tests were administered to attendees when they registered for the program (Table 1). The same test was administered after the program, and attendees were required to obtain 70% or more correct answers to become "certified."

Statistical Analysis

Analysis of variance (ANOVA) was performed using PROC GLM of SAS to determine whether there was an increase in scores between tests taken before and after the course and also whether the mean change differed across training sessions.⁹ ANOVA was also used to examine differences in scores among groups of participants, either before or after the training session (Table 2).⁹

Survey

A survey (available from the author upon request) was conducted just prior to the start of each training program on participants of the first three training sessions. The purpose was to obtain information on producers' opinions and knowledge of drug use and the sources producers used to obtain information on animal drugs. The survey was conducted just prior to the start of the program so that the training did not influence the results of the survey. The results of the survey were used to characterize the producers' awareness of drug use and regulations.

RESULTS

A total of 348 individuals attended the seven sessions and completed both sets of testing. A significant ($P < .0001$) increase was found between test scores before and after the program, and the increases varied significantly ($P = .0005$) with date of the program. The August 6, 2002, program involved extension agents and producers, who had higher mean scores and lower mean increases than did groups on other program dates. Overall, the

mean \pm SD for the pre-program test score was $86.9 \pm 11.8\%$, compared with $97.0 \pm 5.1\%$ for the post-program score ($10.2 \pm 10.7\%$ increase).

A total of 113 goat producers completed the survey. These producers represented 47 of the 100 counties in North Carolina. Average herd size was 35 adult goats (range, 0 to 450). Most respondents (64.6%) raised goats for meat purposes, whereas 30/113 (26.5%) reported raising goats for mixed, multiple, or other purposes. A total of 2/113 (1.8%) of respondents reported keeping goats as pets. Two (1.8%) respondents indicated that goats were kept for show purposes. Six of 113 (5.3%) did not report a use or reported other uses.

Sources for animal health information are given in Table 3. The most common response of producers was that animal health information was obtained from mixed or multiple sources (26.5%). These multiple sources included veterinarians, extension personnel, magazines, other sources, another producer, and the feed store. Next to multiple sources, the most common sources of animal health information in decreasing order of frequency were veterinarians, extension agents, other producers, other sources, magazines, and the feed store (Table 3). The internet was noted several times as one of the other sources.

Producers most frequently (46.9%) obtained drugs from feed stores (Table 3). Next most frequent sources of drugs (in order of decreasing frequency) were catalogs (22.1%), veterinarians (15.1%), drug suppliers (9.7%), and multiple or other sources (6.2%).

Producers' use of veterinarians was reported as common for 38.0% of producers, only when necessary by 28.3%, rarely by 24.8%, never by 7.1%, and not applicable by 1.8% of producers.

Nearly all producers (99.1%) reportedly read labels prior to drug use. No respondent reported not reading labels prior to drug use. One respondent reported that the question was not applicable. A majority of respondents (77.0%) reported that they could NOT buy and/or use any drug they

Table 1. Test Administered to Meat Goat Producers Before and After Quality Assurance Training Program

I. Please answer the following questions as Yes=Y or No=N, based upon whether you agree with the statement or think it is correct:	
1. A goat producer can use any drug in goats that can be legally obtained.	Yes No
2. Mixing two different drugs in a syringe is a good idea because then only one injection is required.	Yes No
3. Residues can be reduced by herd health programs because less drugs may be used for disease treatment.	Yes No
4. Records should be kept of drugs administered, indicating animals treated, drug used and withholding times.	Yes No
5. The loin or back leg is a good site for intramuscular injections in goats used for meat.	Yes No
6. SQ or SC refers to subcutaneous injections.	Yes No
7. Nearly all animal drugs are approved for use in goats.	Yes No
8. I can use nearly any dewormer on a goat and then sell it to slaughter the next day.	Yes No
9. Improper or dirty injection can cause abscesses or scar tissue.	Yes No
10. A valid veterinarian/client/patient relationship simply means that you called a veterinarian for advice, even if he/she has never been to your farm.	Yes No
II. Multiple Choice: Circle the correct answer	
A. The best site for an IM injection with respect to preventing damage to the meat is the:	
1. Neck	
2. Loin	
3. Leg	
B. The withdrawal time for a drug is the time from injection until:	
1. They get over the effect of the medication	
2. The animal is due for retreatment	
3. The meat is safe to consume	
C. The smallest gauge needle of these is the	
1. 14 gauge	
2. 16 gauge	
3. 20 gauge	
III. Which is the safest route with respect to avoiding carcass damage:	
1. SQ or SC	
2. IM	
3. Intraperitoneal or IP	
IV. How can facilities adversely affect product quality	
1. Water gets feet wet and damages meat	
2. Poor upkeep such as protruding nails or sharp edges can injure animals and damage meat	
3. Clean and dry housing areas can dry skin and meat	
V. Producing quality meat products can:	
1. Enhance product demand	
2. Enhance product returns (bad products returned)	
3. Decrease product demand	
VI. Use of a product in a species, at a dose, or in any way different from the label is called:	
1. Correct use	
2. Extra-label use	
3. Creative use	
VII. Which is a good site for a subcutaneous (SQ) injection:	
1. Leg	
2. Ear	
3. Neck	
VIII. You are going to use a new drug for the first time. One thing you should definitely do is:	
1. Warm it up in hot water	
2. Put it in the microwave	
3. Read the label	
VIII. Which is a common needle length for IM injections:	
1. 1/8 inch	
2. 1 to 1 1/2 inches	
3. 4 inches	

Table 2. Test Scores for Meat Goat Producers Before and After Attending Quality Assurance Training Program by Date

Program Date	n	Before Program		After Program		Increase	Range
		Mean ± SD	Range	Mean ± SD	Range		
June 19, 2001	27	85.9 ± 13.1	50–100	99.1 ± 2.0	95–100	13.2 ± 13.2	-5–50
January 17, 2002	57	88.4 ± 10.1	55–100	98.3 ± 3.3	80–100	9.9 ± 9.4	-5–40
August 6, 2002	24	97.7 ± 4.2	85–100	98.8 ± 3.4	85–100	1.0 ± 5.3	-15–10
August 14, 2002	66	85.4 ± 13.6	40–100	98.2 ± 3.2	85–100	10.2 ± 10.7	-15–55
February 13, 2003	63	85.7 ± 11.9	45–100	96.0 ± 4.8	75–100	10.2 ± 11.1	-10–50
August 7, 2003	70	84.9 ± 9.5	60–100	95.0 ± 7.0	65–100	10.1 ± 8.6	-15–35
August 27, 2003	41	86.7 ± 13.0	50–100	96.3 ± 6.9	75–100	9.6 ± 10.0	0–55
OVERALL	348	86.9 ± 11.8	40–100	97.0 ± 5.1	65–100	10.2 ± 10.7	-15–55

wish, even if extra-label. Fourteen (12.4%) reported that they could buy and use any drug they wish. Twelve of 113 (10.6%) responded “not applicable.”

A majority (75.2%) of responding producers reported understanding what a drug withholding time was. A total of 24 (21.2%) producers reported that they did not understand what drug withholding time was; 3.5% responded that the question was not applicable. A majority of producers (80.5%) reported knowing what the drug withholding period was for drugs or dewormers they used, whereas 20 (17.7%) did not. Two respondents (1.8%) reported that the question was not applicable.

The most frequent (31.9%) source reported for drug withholding information was the drug company or drug seller. This was followed in decreasing frequency by other sources (14.2%), extension (13.3%), veterinarians (12.4%), multiple sources (10.6%), catalogs (8.8%), neighbors (6.2%), and not applicable (2.6%). The multiple source category included veterinarians, extension, drug company/seller, catalogs, neighbors, and other sources.

Respondents were approximately equally split on whether they understood what extra-label drug use was (48.7% responded yes and 46.0% reported no). Six (5.3%) respond-

Table 3. Meat Goat Producer Responses (n = 113) Regarding Sources of Animal Health Information and Drugs for Their Goats

Sources of Animal Health Information		Sources of Drugs	
Multiple	30 (26.5%)	Feed store	53 (46.9%)
Veterinarian	22 (19.5%)	Catalog	25 (22.1%)
Extension service	21 (18.6%)	Veterinarian	17 (15.1%)
Another producer	17 (15.1%)	Drug suppliers	11 (9.7%)
Other source	12 (10.6%)	Multiple and other	7 (6.2%)
Magazine	5 (4.4%)		
Feed store	4 (3.5%)		
Not applicable	2 (1.8%)		

ed “not applicable.” Most respondents (80.5%) reported that they understood what a valid veterinarian-client-patient relationship was; 16.8% reported they did not, and 3 (2.7%) responded “not applicable.”

Dewormer use was reported by producers (Table 4). Ivermectin was commonly used as a first-choice dewormer (54.0%), followed in order of decreasing frequency by moxidectin, fenbendazole, albendazole or medicated feed (tied), levamisole, and doramectin (Table 4). A total of 17 respondents (15.0%) reported that their first choice of dewormers was none or not applicable. The most frequent response for second choice for dewormers was none, no response, or not applicable (48.7%). Frequency of responses for second choice for dewormers in order of decreasing frequency was ivermectin, fenbendazole, moxidectin, albendazole, levamisole, doramectin (2 responses), and medicated feed (2 responses).

Table 4. Dewormers Reportedly Used by Meat Goat Producers (n = 113) in Survey During Quality Assurance Program

Dewormer	First Choice	Second Choice
Ivermectin	61 (54.0%)	17 (15.0%)
Moxidectin	12 (10.6%)	11 (9.7%)
Fenbendazole	8 (7.1%)	14 (12.4%)
Albendazole	5 (4.4%)	8 (7.1%)
Medicated feed	5 (4.4%)	2 (1.8%)
Levamisole	3 (2.7%)	4 (3.5%)
Doramectin	2 (1.8%)	2 (1.8%)
None, no response, or not applicable	17 (15.0%)	55 (48.7%)

DISCUSSION

It is critical for the developing meat goat industry to develop and maintain a reputation for safe and high-quality products. The program used here was similar to quality assurance programs used by other major animal production industries. Materials or general guidelines from other animal production industries and authors were used as the basis of the quality assurance material or were modified for the meat goat industry.^{1,2,3,7,10,11}

Goat producers face some major differences and difficulties compared with other major meat-producing animal industries. The meat goat industry is smaller than other major meat-producing animal industries such as the poultry, swine, or beef industries. For obvious reasons, economics is an important consideration when animal health and feed companies consider product development. Because of this, few animal health products are FDA-approved for use in meat goats. As of June 2001, when the training program was initiated, the FDA listed seven drugs approved for use in goats, including ceftiofur, decoquinate, fenbendazole, monensin, morantel tartrate, neomycin, and thiabendazole. Because there are so few drugs approved for goats, extra-label drug use in these animals is a frequent occurrence in the US. Extra-label use in this country is permitted only by or under the direction of a veterinarian following carefully prescribed regulations.¹² This necessitates producers having a good working relationship with a veterinarian, so that a valid veterinarian-

client-patient relationship is present. The regulation and importance of this relationship was emphasized during the training sessions.

Approvals for minor species and minor uses of drugs in animals is being improved via the efforts of the Minor Use Animal Drug Use Program.¹³

A major concern for goat producers is the perceived cost of working with a veteri-

narian. Most meat goat operations are small and are not the major means of income production for the individuals involved. Income and profits are small, necessitating careful control and monitoring of expenses. Because of the frequent need for extra-label drug use in goats, it is especially important for the producer to have a good working relationship with a veterinarian who can prescribe or direct such extra-label drug use and be a source of withholding times for such use.

Tests completed by participants before and after the program demonstrated a significant increase in scores associated with the training course. The majority of participants became "certified" producers. Mean scores did vary somewhat among the training dates. One of these was a small training sessions held in August of 2002 and consisted of extension agents with a strong interest in the industry, along with selected producers. Many of these individuals had heard similar material before, so their pre-test scores were quite high. In general, the improvement associated with the training was rewarding for the examiners. These results were of the same magnitude as shown in a European evaluation of training, certification, and career development strategies for livestock industry workers.¹⁴

Surveys were returned from 113 participants of the first three training sessions. Average herd size for these respondents (35 adult goats) was small, with the majority (64.6%) being kept for meat purposes. Survey respondents gave information about several

aspects of their drug use. Appropriately, respondents indicated that they most commonly (26.5% of respondents) obtained animal health information from multiple sources.

It was not surprising that nearly half of the respondents indicated that the source of their animal health products was the feed store. When asked about the use of veterinarians, respondents most frequently (38.0%) reported veterinarians were commonly used, followed by almost equal number reporting that they only used veterinarians when absolutely necessary or never. One can speculate that there is considerable extra-label drug use in the meat goat industry that is not directed by a veterinarian.

A large majority of responding producers indicated that they understood what a drug withholding period was, and that they also knew the withholding times for the drugs they used. By far, the most common source of drug withholding information was the drug company or drug seller. This was followed by a variety of additional responses, including the veterinarian, extension agents, and other producers. Although not known for certain, it is likely that the drug withholding information that producers obtained from the drug label applied to the species for which the product was labeled. For example, a pour-on cattle dewormer would give drug withholding information, but it would be for use on cattle at the dose recommended for cattle. Because extra-label drug use should only be by or on the direction of a veterinarian with a valid veterinarian-client-patient relationship, it is a concern that the veterinarian was infrequently mentioned as a source of drug withholding information. This could imply that veterinarians are not often giving information on drug withholding or that few drugs are obtained from veterinarians.

It was encouraging that a large majority of producers reported that they read labels prior to use of drugs. It was also encouraging that a large majority of producers understood that they could not legally use any drug product that they not legally obtain. Further, a large percentage of respondents stated that

they understood what a valid veterinarian-client-patient relationship was. Producers were reportedly less certain what was meant by extra-label drug use. In all cases, it is important to note that the responses only indicate what the producers reported they understood or knew. They were not specifically tested to verify their responses.

CONCLUSION

A meat goat quality assurance training program was developed and tested on 348 meat goat producers in North Carolina. Significant increases were found in test scores after the respondents completed the training program. A survey was administered to a subset of producers prior to the start of the training session to assess their understanding and opinions on some aspects of drug use. Producers most commonly obtained animal health information from multiple sources and most frequently obtained their drugs from the feed store. A majority of producers indicated that they read drug labels prior to drug use and that they understood what a withholding period was and also know the withholding periods of drugs and dewormers they used. Meat goat producers had reasonable awareness of drug use regulations and the training program increased their apparent knowledge of meat goat quality assurance.

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