Small ruminant quality assurance (SRQA) – considerations and practices

Michael Pesato, DVM, DABVP (Food Animal Practice)

Four State Veterinary Services
Newark, DE 19702

Abstract

There are multiple quality assurance programs in existence for livestock industries in the United States. This includes the Beef Quality Assurance program and Pork Quality Assurance Program. Although technically a Sheep Safety and Quality Assurance program does exist through the American Sheep Industry Association, it is not as nationally known or recognized compared to programs featuring major food animal species. No formal quality assurance programs exist for goats in the United States. This proceeding will discuss aspects of small ruminant (sheep and goat) management, preventive medicine and medical treatment that influences quality assurance.

Key words: small ruminant, quality assurance, management, preventive medicine

Defining quality assurance and existing quality assurance programs

According to Merriam-Webster dictionary, quality assurance is defined as "a program for the systematic monitoring and evaluation of the various aspects of a project, service, or facility to ensure that standards of quality are being met". The livestock industry has been practicing quality assurance for decades. The official Beef Quality Assurance program as it exists today began in the 1990s, although an assurance program had started as early as the 1970s. The Pork Quality Assurance program was launched in 1989. A sheep quality assurance program known as the Sheep Safety and Quality Assurance program was formulated in 1991 and has been consistently updated by the American Sheep Industry Association. Unlike the pork and beef program, the sheep quality assurance program includes discussion on dairy and wool production. To the author's knowledge, there does not currently exist an official national quality assurance program for goat production in the United States.

Quality assurance programs focus on being proactive and the prevention of quality failures. Quality assurance takes place throughout the process of product development. The Beef Quality Assurance program outlines that "best practices around cattle handling, facility management, cattle transportation, good record keeping and protecting herd health…result in better outcomes for cattle and producers". The Pork Quality Assurance Plus program is "…designed to help pig farmers and their employees continually improve production practices… (by) addressing food safety, animal well-being, environmental stewardship, worker safety, public health and community". Finally, the Sheep Safety and Quality Assurance Program utilizes "research and education to improve management during the production of safe and high-quality sheep products". All these programs support prevention and management practices that lead to a better product.

Pillars of quality assurance: Management, preventive medicine, animal medical treatment

Management: Nutrition

Management is paramount for any quality assurance program. Proper management involves multiple factors including nutrition, housing and breeding management. Although many other components of management are important for quality assurance, it is the author's opinion that these 3 areas are among the most important. Nutrition is extremely important for livestock production. Ruminant nutrition involves 5 basic elements – pasture, grain, mineral supplement and water. Pasture and hay make up the roughage component while grain (or other pelleted, carbohydrate-based dietary supplement) provides energy. Mineral supplementation provides both macro and trace minerals. Water is essential to life and should always be accessible no matter the weather or environment.

Although the 5 basic elements provide a well-rounded diet, one element is not essential to every small ruminant. Grain (or other pelleted, carbohydrate-based dietary supplement) is not essential to pets or non-breeding animals and can predispose to obesity (in both males and females) and obstructive urolithiasis (in males). Grain supplementation is most appropriate in breeding females during breeding (the practice of "flushing" to increase ovulations), pregnant females in the last 6 weeks of gestation to prevent pregnancy toxemia, and growing youngstock (supplemented in a creep feeder to limit competition with older animals). Mineral supplementation is recommended for all production-based animals although mineral deficiencies may vary geographically. Mineral supplementation may pose a threat to male small ruminants as supplementation may increase the frequency of obstructive urolithiasis. Pasture and hay, both of which are considered roughage, and water is essential for every ruminant regardless of use.

Hay must be assessed by the veterinarian as it is common for producers to feed poor quality hay as a staple of the diet. Hay should be soft to the touch with a dull green color. It should not turn to dust when separated but instead be pulled apart into distinct flakes. The content of the hay should be primarily leaves with minimal stems and seedheads. The rumen is full of bacteria that are cellulolytic, meaning that they are efficient at digesting cellulose. Cellulose is the structural component of young plants. As the plant ages, this cellulose becomes lignan. Lignan is not digestible by the rumen. Poor quality or aged hay will appear course with a tan color. This hay (or, unfortunately in some cases, straw) will have minimal to no leaves and contain primarily hardened stems. Instead of the rumen breaking down this material, this hay will stay in the rumen and make the animal appear "full". The animal will, however, not gain much nutritional value from this material, if any at all. The best

way to provide the client with information concerning the quality of the hay they are feeding is to submit a sample of the hay to a feed analysis lab. Otherwise, the tips shared above can aid the veterinarian in helping the farmer to understand what constitutes "good hay" vs. "bad hay".

The last nutritional management point has less to do with what is being fed and more to do with how it is being fed. It is extremely important that all feed material be elevated from the ground. Hay may be placed in commercially available or homemade feeders that keep the material from being consumed on the ground. Grain and minerals should be placed in troughs or containers that keep it from being on the ground. This helps to prevent soiling of the feed material and subsequent feed refusal from the small ruminant. It also helps to decrease the amount of parasite exposure these animals have; by elevating the feed from the ground there will be decreased contamination of the feed material with infective larvae. This will help to decrease losses from parasitism if the practice is put in place.

Management: Housing

Housing is an important component of quality assurance as it directly influences animal health and can influence the product produced. Proper housing with quality ventilation that prevents health events such as respiratory disease can impact a herd or flock. Facilities and buildings that provide shelter from the elements can be an important part of the production system or may not be necessary depending on the herd and/or flock. For example, range flocks in the western United States may not provide technical housing facilities every day of the year. If housing is provided, it is important that there are no areas that can lead to animal injury such as loose nails and screws or broken boards, paneling or beams. These can lead to hide damage and muscle bruising and cause everything from minor lacerations to death. Improper housing can jeopardize the quality of the product being produced by jeopardizing animal health and safety.

Management: Breeding program

The breeding program influences quality assurance in multiple ways, and often ties in other components of management. A proper breeding program allows for the creation of uniform lamb and kid crops. Breeding programs also give producers the ability to feed dams, bucks/rams and kids/lambs appropriately because the pregnancy status and stage of production is known. Housing requirements for males and females can be met – males can be separated from females during the off-season and housed in an appropriate location. It is also easier to implement preventative medicine within the herd or flock. For example, when pregnancy status and suspected due date is known, dams can be vaccinated 4-6 weeks from giving birth to ensure that antibodies are being produced into the colostrum for offspring. Having a well-established breeding program opens multiple opportunities for better management.

Two options exist for breeding programs – a natural breeding program or artificial breeding program. For a natural breeding program, it is important to remember that small ruminants are considered seasonally polyestrous. The peak sexual receptivity timeframe is generally in the fall as small ruminants are considered short-day breeders. There are some exceptions to this rule (Finnish Landrace sheep, Dorset sheep and Kiko goats, for example), but even the exceptions are most receptive in the short-day period.

The estrous cycle length differs between sheep and goats. For sheep, the estrous cycle lasts 17 days. For goats, the estrous cycle lasts 21 days. This is important to remember when implementing a natural breeding program as it is recommended that the ram or buck is kept with the ewes or does through 2 estrous cycles. This will help achieve the highest possible pregnancy rate and keep a succinct lambing or kidding season. The gestational length is similar for sheep and goats though sheep average around 147 days while goats average around 150 days. The time of year desired for a lambing or kidding season may differ geographically. For example, in the northeastern United States, lambs and kids are desired in the spring – ideally in March or April to avoid cold temperatures and possible snow/ice in late winter. This would mean that the breeding season would have to be from October to November. In the southeastern United States, lambs and kids are desired in January or February to avoid early spring heat and subsequent flies. This means that the breeding season is usually late August into September.

Regardless of breeding season, it is important to have some knowledge of when the ewes or does are bred. This can be achieved simply by watching the ram or buck and marking activity with pen and paper or via digital records. However, it is recommended that a marking harness fitted to the rams or bucks. This system allows the males to breed the females and leave a colored mark. The date of the breeding can then be recorded. After the male has been with the females for one estrous cycle, the marker color should be changed. This will help to indicate females that were bred later in the season or mark animals bred a second time. Multiple colors can also be used for multiple males with each color indicating a specific male.

Artificial breeding programs are more labor-intensive for producers. These programs involve hormonal synchronization of the female in preparation for breeding. This proceeding will not detail specific synchronization protocols; however, it is important to note that the majority of small ruminant synchronization protocols involve the use of a controlled internal drug releasing (CIDR) insert. This provides progesterone and will stay in the animal for a certain period. After removal, hormones including prostaglandin, gonadotropin-releasing hormone (GnRH), or chorionic gonadotropin are used to influence the estrous cycle. Artificial insemination of goats can be achieved via a transcervical approach where artificial insemination of sheep is best achieved via intrauterine insemination using laparoscopic surgery.

Breeding soundness examinations are strongly recommended for any breeding program although only a brief review will be provided here. This examination of the male should be performed once a year prior to the breeding season. The breeding sounding examination involves 2 components – the physical examination and semen evaluation. A full physical examination should be performed on the male paying special attention to the animal's ability to see and making sure the animal has healthy feet and leg conformation. The scrotal circumference and palpation of the testicles for abnormalities should also take place at this time. The male should be ejaculated either using an electronic ejaculator device (sheep) or an artificial vagina (goats). The semen will then be assessed for motility and morphology. It is important to remember that a motility of less than 30% and normal morphology of less than 50% is considered not acceptable.

Preventive medicine

In the author's opinion, the most important component of preventative medicine that concerns quality assurance is vaccination. There are for main concepts when discussing vaccination – what preventive to give, when to give the preventive, how to give the preventive, and how to store the preventive. There are multiple vaccinations available for small ruminants including clostridial vaccinations (both 3-way clostridial vaccination and 8-way clostridial vaccination), rabies vaccination, caseous lymphadenitis vaccination, contagious ecthyma vaccination, and leptospirosis vaccination. The 3-way clostridial vaccination is the only vaccine on label for both sheep and goats. All other vaccinations except for the leptospirosis vaccination are on label for sheep while the immunization for leptospirosis is extralabel for both sheep and goats.

The only core vaccination recommended for small ruminants across the globe is the 3-way clostridial vaccination which covers *Clostridium perfringens* type C and D and *Clostridium tetani*. The author recommends use of the 8-way clostridial vaccination for producers located in areas where liver flukes are endemic (this vaccine will protect against *Clostridium novyi* type B and *Clostridium haemolyticum*). It is recommended that dams are vaccinated 4-6 weeks prior to giving birth, allowing for adequate transfer of antibodies into colostrum for offspring. Offspring from dams vaccinated during this time will receive the first dose of vaccination at 4-6 weeks of age. A booster will then be administered 3-4 weeks (3-way vaccination) or 6 weeks (8-way vaccination) from the first injection. If the offspring are from an unvaccinated dam, they must be vaccinated within the first week of like and then a booster will then be administered 3-4 weeks (3-way vaccination) or 6 weeks (8-way vaccination) later. Any adults with unknown vaccine history should be vaccinated immediately followed by a booster administered 3-4 weeks (3-way vaccination) or 6 weeks (8-way vaccination) later. Every animal should receive at least annual vaccinations although evidence shows that the duration of immunity in goats may be shorter than sheep supporting vaccination every 6 months. The vaccine label should always be consulted for appropriate volume of administration and time between booster shots.

There are no approved respiratory virus vaccinations for small ruminants in the United States. One vaccination against *Mannheimia haemolytica* and *Pasteurella multocida* is commercially marketed and approved for use in goats and sheep in the United States. Many producers want to utilize respiratory viral and bacterial vaccinations approved only for cattle in their sheep and goats. There has been no strong correlation of protection between species for respiratory viruses. As for bacteria, the classic serotype for *M. haemolytica* included in cattle vaccinations is A1 while small ruminants have serotype A2. The serotype included for *P. multocida* in cattle products is A6; small ruminants generally have serotype A2. Therefore, products strictly labeled for cattle are not very protective against respiratory viral or bacterial infection in small ruminants.

All vaccines should be stored between 35 and 45 °F. This relegates that all vaccines should be stored within a refrigerator. Vaccines should be kept out of direct sunlight and should never be frozen. Producers should exercise caution when ordering vaccinations and having the product shipped. If the vaccinations arrive warm, the efficiency will be greatly decreased or non-existent. Vaccination administration can occur in three locations on the small ruminant. First, the subcutaneous space found over the neck using 3 main landmarks can be used. The landmarks include the nuchal ligament as the dorsal most landmark, the cervical spine as the ventral most landmark, and the border of the scapula as the caudal most landmark. Other subcutaneous vaccinations can be given the axilla or over the brisket. Mild to moderate reaction sites noted as well demarcated, swollen, firm nodules may occur following clostridial vaccination. These reaction sites may become abscessed and rupture to drain. They may develop secondary bacterial infections and/or cause the animal discomfort. It is important to warn clients of this possible sequela.

Animal medical treatment

This proceeding will discuss proper and judicious use of anthelmintics and antibiotics in small ruminant practice. The use of medications in a judicious fashion, described as having, showing, or done with good judgement or sense, is essential to ethical and sound practice. Several helpful tips will be outlined to make judicious use easier for both practitioner and producer alike.

All anthelmintics are available over the counter. This complicates the idea of judicious use when producers have access to anthelmintics with no veterinary oversight. One way that veterinary oversight can be implemented is with the development of treatment protocols. Treatment protocols define the disease process, provide descriptions that allow the producers to identify the disease, and provide the proper dose, frequency, route, and duration. Treatment protocols also provide withholding times, if available. Producers and clients can also be taught to dose and administer anthelmintics appropriately. It can be very challenging to get an accurate weight on-farm, but weight tapes made for dairy goats or cattle may help. Although no weight tape has been specifically made for sheep, a formula can be used to help guesstimate the weight of each animal. To achieve a weight estimate, the following should be performed. Measuring in inches, measure the heart girth (around the chest from the withers to just behind the elbows) and the length of the body of the animal (from point of shoulder to caudal aspect of the ischium). The formula for weight estimation is as follows:

$$\frac{\text{Heart girth x Heart girth} \times \text{Body length}}{300}$$

This formulation will give the weight in pounds. Although this is just an estimation, it may aid in deciphering what an accurate weight may be for the animal. The American Consortium for Small Ruminant Parasite Control has published charts with proper doses for all small ruminant dewormers. These charts are peer-reviewed and should be offered as valuable guides when it comes to recommending dosing of anthelmintics.

Medication should also be administered correctly using a drenching gun or drenching syringe (with a characteristic "elbow" or bend in the metal end that enters the mouth) to administer anthelmintic into the oropharynx and ensure the animal swallows. Proper administration of anthelmintics includes following labeled routes. For example, giving injectable ivermectin as an oral product or topical moxidectin as an oral product is inappropriate. Administering products in an inappropriate fashion decreases their efficacy which drives resistance development among parasites. Lastly, anthelmintics should be stored between 66 and 77 °F. A clean, dry area with no direct sunlight is appropriate for storage. Refrigeration or freezing of anthelmintics is not recommended.

Antibiotics, unlike anthelmintics, are no longer available over the counter. All antibiotics are now prescription only. When prescribing antibiotics, treatment protocols (like what was discussed above) should be formulated for producers and clients that have access to antibiotics. These treatment protocols should provide dose, route, frequency and duration as well as withholding times for meat and milk. It can be challenging to get accurate doses for small ruminants as many antibiotics are not specifically labeled for sheep and goats. It is pertinent to remember that sheep and goats are not small cattle and therefore the cattle dose is not always appropriate for the small ruminant. Utilization of references (i.e. *Goat Medicine* by M.E. Smith and D.M. Sherman) with small ruminant specific formularies is a necessity. Appropriate route must be followed when administering antibiotics. Antibiotics that are made to be injectable should not be administered topically onto sensitive tissue such as the cornea, for example, or used in an intramammary fashion.

Storage of antibiotics varies greatly between products. It is advisable to refer to product labels and follow label instructions for storage. Most antibiotics should not be exposed to direct sunlight, and many should not be frozen. As mentioned earlier, there are very few products that are labeled for sheep and goats and even fewer labeled for both small ruminants. Finding an appropriate withholding time for both meat and milk in most cases will require inquiry to the Food Animal Residue Avoidance Databank (FARAD). Fortunately, a request option is available via farad.org that allows for such an inquiry resulting in feedback within 72 business hours. As part of quality assurance, it is paramount that withholding times are provided to producers when antibiotics, anthelmintics or other medication is administered or prescribed by the veterinarian.

Conclusion

Although quality assurance programs for small ruminants are not as prominent as programs designed for beef or pork, there are still ways that producers can ensure quality assurance by working with their veterinarian. Incorporating management strategies focusing on quality nutrition, safe and stable housing, and timely breeding programs helps to ensure a healthy animal and quality product. Incorporating preventative medicine practices and judicious use of antibiotics also helps to guarantee quality. Veterinarians play an important role in aiding producers to establish a quality assurance program that focuses on animal health and well-being which will ultimately increase profit for the producer.

References

Beef Quality Assurance. Accessed August 3, 2023. **https://www.bqa.org/about-us/landing**

Pork quality assurance and audit tools. Michigan State University. Accessed August 3, 2023. **https://www.canr.msu.edu/pork/Quality-Assurance-and-Audit-Tools/#:~:text=The%20Pork%20Quality%20Assurance%20(PQA,good%20production%20practices%20on%20farms**

Quality assurance programs. American Sheep Industry Association. Accessed August 3, 2023. **https://www.sheepusa.org/assuranceprograms**

Deworming. American Consortium for Small Ruminant Parasite Control. Last Updated May 25, 2023. Accessed August 3, 2023. **https://www.wormx.info/deworming**