Introduction

The general public has a growing concern over the safety of food products purchased and consumed due to issues such as food-borne illnesses due to pathogens, the use of drugs in animal production, and the possibility of drug or chemical residues in food products. Quality assurance programs to ensure a safe, sanitary food supply using the Hazard Analysis and Critical Control Points Analysis Program (HACCP) have been implemented by the beef, pork, and other food industries. Adoption and use of HACCP-like principles and programs in the goat industry can assist in ensuring that goat products are as safe as possible.

The HACCP system addresses food safety beginning at production and continuing through processing and marketing. In the area of processing, the U.S. Department of Agriculture mandated that meat and poultry processing establishments begin using HACCP by January 1999 to improve product safety. Small processing establishments were given a period until January 2000 for implementation.

The issue of a safe, wholesome food product is important for all goat producers. For the goat industry to successfully implement a HACCP-like program, it will take effort and commitment during all stages of production from farm to table. There are seven HACCP principles that assist producers and industry to identify, evaluate, control, and, finally, prevent food safety hazards.

HACCP Principles

1. **Conduct a hazard analysis.** Identify potential hazards in your production system that could allow for damage resulting in a lesser quality product or a means of introducing chemical or drug contamination.

2. **Determine critical control points.** Critical control points are those times in production or processing where hazards could occur resulting in lower quality products and where production changes or interventions should occur.

3. **Establish critical limits for control points.** Set limits to prevent problems from occurring, e.g., follow manufacturers limits on feed additives or drug withdrawal times.
4. Establish monitoring procedures for control points. These procedures assist in determining if critical limits have been adhered to.

5. Establish corrective actions. Actions to be taken when monitoring procedures indicate a problem.

6. Establish verification procedures. These procedures verify that proper corrective measures were taken and have been effective.

7. Establish record-keeping and documentation procedures. Records should be kept on identified problems, corrective steps taken, effectiveness, and methods to prevent future occurrences.

Education and Training

The key to a successful HACCP system and the assurance of a safe food supply begins with education and training. Proper information and training in management practices must be available to producers. Producers should understand the HACCP process and be able to adapt the seven principles to their production system. Owners and managers should ensure that all persons working in their production system have access to HACCP guidelines and information on proper management practices. Proper equipment appropriate to each task must be provided to all employees. This will assist in ensuring proper workplace procedure and implementation of HACCP guidelines. Importantly, each person must be aware that they are working with food-producing animals and that the production of safe goat products begins with them.

General Management

Production of safe goat products begins with the management and treatment of animals on farm. Proper management of goats decreases the stress placed on animals and results in healthier, more efficient livestock with reduced incidence of disease. Obvious benefits include decreased veterinary and drug costs, decreased labor requirements to isolate and treat sick animals to a healthier total herd. Less obvious results include a reduced chance of the appearance of drug residues in goat products and easier adherence to HACCP-like guidelines. Therefore, some general management concerns for quality goat production are outlined below.

Housing

Most meat and fiber producing goats are raised on pasture in extensive production systems. In these systems, natural shelter may be sufficient. However, goats do need shade during hot, summer months and a place to escape rain and wind at other times. A simple, three-sided shed is sufficient in most cases. Dairy goats in the U.S. are raised in a variety of systems ranging from pasture to total confinement in specially built barns. Cleanliness and manure handling are important to maintain herd health and reduce disease. Milking facilities should be easy to clean and meet all federal and state dairy standards. Hay can be fed off the ground, although this usually results in
some wastage. In general, goats prefer to eat feeds fed off of the ground and the use of feeders may improve feed efficiency and reduce possibility of transmission of parasites and other diseases.

**Kidding Housing**

Kidding during the cold months may be necessary to target special holiday kid markets or to facilitate year round kidding schedules. If so, the use of kidding pens under sheds or in barns will usually improve kid survival and early doe and kid performance. Special facilities may not be necessary when kidding during warmer months.

**Identification**

The proper identification of animals is essential for all aspects of efficient livestock production. There are two basic types of identification: permanent and temporary. Tattooing is the best method of permanent identification. Ear tags are a very commonly used form of identification.

**Hoof Trimming**

Goats need to have strong feet and legs to survive. Overgrown hooves can cause goats pain and suffering. Goats with overgrown hooves may not be able to move to where the feed may be located resulting in poor nutrition. An inadequately fed goat is more at risk for disease occurrence.

**Premature or Weak Kids**

At birth, two management practices are critical to the future health and survival of the newborn kid. The navel cord should be dipped in a solution of tincture of iodine to prevent entry of disease-causing organisms through the navel cord and directly into the body of the kid. The second critical practice is the feeding of colostrum as soon after birth as possible. The colostrum, or first milk, is rich in antibodies. Kids should receive colostrum equal to 10% of their body weight within 24 hours. For example, a six pound (3 kilogram) kid should receive 300 mL of colostrum within 12 hours. Excess colostrum can be frozen for use with orphaned kids. If no goat colostrum is available, it is better to substitute cow colostrum than provide none.

**Castration**

Buck kids that will not be used for breeding should be castrated. Kids should be castrated at less than fourteen days of age as castration becomes more traumatic with age. Two very efficient, and low cost methods are elastraction and the knife.

**Disbudding**

If disbudding is a practice to be followed, it should occur within the first two weeks of life. Buck kid horns grow faster than doe horns. Some large single buck kids should be disbudded within
the first week. The equipment most commonly used is an electric-heated metal rod with a hollowed-out end.

_Fencing_

Fencing is an important key to successful goat production. Correct fencing will make management easier and reduce loss of livestock. There are many types of fencing suitable for goats.

Outlined below are some of the fencing types used by goat producers.

1. Goat Net Wire Fence
2. Barbed Wire - 10-12 strand
3. Converted 5-Strand Barbed Wire Fence with Addition of 4 Strands of Barbed Wire
4. Converted 5-Strand Barbed Wire fence by Addition of 8-35 Net Wire Fence
5. Converted 5-Strand Barbed Wire Fence with Addition of 1 or 2 Strands of Electric Fence
6. Temporary Electric Fence
7. Permanent Electric Fence
8. Gallagher Electric Fence

_Predator control_

Goat owners recognize that a profitable goat enterprise must keep losses from predators to a minimum. Coyotes, feral dogs, packdogs, seemingly harmless neighboring dogs, foxes, eagles, owls, etc. can be killers of kids and adult goats. Control measures used are special fencing, guns, snares, traps, poisoned baits, cyanide guns, toxic collars, guard dogs, donkeys, llamas, night penning and stabling. The three most-used breeds of guard dogs are Great Pyrenees, Kommondor and Anatolian. Check with local officials prior to using poisoned baits, cyanide guns, etc.

_Herd Health_

A healthy herd will keep expenses to a minimum and provide greater efficiency of production. Perhaps the number one piece of equipment needed is a thermometer. You should use it whenever an animal is acting abnormal as body temperatures usually rise 24-36 hours before clinical signs appear. Normal body temperature of a goat is 101.5-103°F. Anything over 104°F should be considered a fever and immediate action must be taken to lower the body temperature. Outlined below are some of the common diseases encountered by goat producers.

_Common Diseases_

1. Acidosis
2. Bloat or Ruminal Tympany
3. Caprine Arthritis Encephalitis (CAE)
4. Caseous Lymphadenitis
5. Colibacillosis
6. Contagious Ecthyma
7. Enterotoxemia
8. Enzootic Abortion
9. Floppy Kid Syndrome
10. Johne's Disease
11. Milk fever (Parturient paresis, Hypocalcemia)
12. Pinkeye
13. Polioencephalomalacia
14. Pregnancy Toxemia (Ketosis)
15. Ringworm
16. Tetanus
17. Urolithiasis

Some of these common diseases can be prevented by vaccination. They are:

1. Contagious Ecthyma
2. Enterotoxemia
3. Tetanus

Injection Methods and Sites

Medications are to administered either intramuscularly (IM), subcutaneously (SQ), intravenously (IV) or intraperitoneally (IP). IM and SQ injections are the most common and IP the rarest that a goat producer will encounter. IM injections are directly into the muscle, the best site being the heavy neck muscle. The muscles of the hindquarters are to be avoided as this could result in injection site blemish that may have to be trimmed from this high quality wholesale cut. SQ injections are given between the skin and the underlying muscular tissue. Preferred SQ site for the injection is generally anywhere over the rib cage or shoulder, near the point of the elbow. IV injections are directly into the jugular vein in the neck and require training. IP injections are directly into the peritoneal cavity or abdominal cavity and in general should only be done by a veterinarian.

Parasite Control

Parasites of goats are often shared with sheep even though the two species are different in their dietary selection and ability to extract nutrients from forages. There is no one answer as to how to control parasites of goats. However, there are several approaches that may be taken when one has an idea of when and where parasites are being acquired and how parasites survive in the environment. Losses caused by parasitic disease varies considerably from death to that of a minor annoyance. The differences may be due to geographic, genetic, or husbandry variability. Control methods should not rely on drug use alone but should be combined with management practices such as pasture rotation to ensure maximum effectiveness. The ever-increasing rise in anthelmintic resistance to common wormers has increased the importance of management in parasite control.
Milk Production and Handling

Goat milk, as stated in the U.S. Grade A Pasteurized Milk Ordinance (PMO), is the normal lacteal secretion, practically free of colostrum, obtained by the complete milking of one or more healthy goats (USDHHS/FDA, 1993). Although the National Conference on Interstate Milk Shipments (NCIMS) recognizes the differences in composition and somatic cell count (SCC) between cow milk and goat milk, sanitary requirements for Grade A cow milk in the PMO apply to goat milk.

The PMO is governed by the Food and Drug Administration and enforced by the State Department of Health or the State Department of Agriculture, specifically by the Milk Sanitation Division. To produce Grade A goat milk, a dairy goat farmer must obtain a permit from the regulatory agency and use an approved facility for milk production and handling.

Mastitis

Mastitis is defined as an inflammation of the mammary gland and is nearly always caused by bacteria. Bacteria infecting the mammary gland are classified into two major categories, contagious or environmental pathogens. Contagious pathogens are spread from an infected udder to a noninfected udder during the milking process. Environmental pathogens are present in the goat’s surroundings, including feces, soil, and bedding. Transmission of pathogens from the environment to the udder mainly occurs between milking, but can also occur during milking.

A sound herd health management program is needed to be successful in the control and prevention of mastitis. This would include the implementation of an udder health monitoring program such as the Dairy Herd Improvement (DHI) testing for milk somatic cell counts. There are six basic elements of an effective mastitis control program. They include: 1) proper milking procedures and milking machine function, 2) teat dipping after milking, 3) providing the goats a clean, comfortable, and dry environment between milking, 4) use of an antibiotic therapy at dry off to eliminate existing infection, 5) cull chronically infected goats to prevent the spread of infection, and 6) keep accurate production and health records of individual goats. Monitoring and control programs will be successful only if the farmer diligently manages the herd and maintains accurate records on each animal.

Handling and Transport

Goats are highly social animals and should be maintained in groups to minimize stress. They generally are responsive to handling by humans, and adapt well to routines. Whenever possible, goats should be habituated slowly to new routines. It is important that all handling experiences are as positive as possible. Handling animals in a manner that excites or provokes them can result in harm to the animal and/or personnel.
Transportation places stress upon goats that should be minimized. Transportation should be planned to minimize length of time to minimize stress. Appropriate handling pens and facilities will also reduce stress. It is also important to provide adequate water and feed at interim facilities where goats may spend considerable time awaiting sale or further transport.

**Record Keeping**

As noted in many of the above sections, proper record keeping is essential. Proper records facilitate the implementation of HACCP-like guidelines and are a useful management tool.

*The above information will be incorporated into a future manual on quality assurance and HACCP-like procedures for goats. Further information can be obtained from the E (Kika) de la Garza American Institute for Goat Research.*
The proper citation for this article is: