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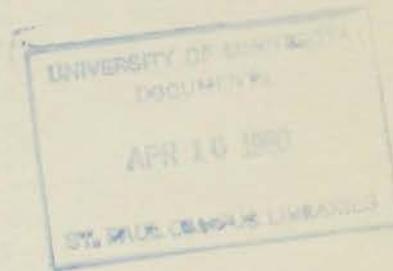
Goats: Goats!

Goats!
Goats!

Goats!

2nd ANNUAL DAIRY
GOAT CONFERENCE

Earle Brown Continuing
Education Center St. Paul
Campus Nov. 10, 1979
University of Minnesota



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2ND ANNUAL DAIRY GOAT CONFERENCE

Earle Brown Continuing Education Center
St. Paul Campus, University of Minnesota
November 10, 1979

PURPOSE

The Second Annual Dairy Goat Conference will provide an in-depth program which will enable dairy goat farmers to:

1. Select and buy dairy goats more effectively.
2. Develop a desirable housing program.
3. Develop a herd health program.
4. Develop a profitable marketing system.
5. Develop a desirable reproduction management program.
6. Learn what product possibilities exist for home steaders.
7. Beginners will develop a herd management system.

PARTICIPANTS

Dairy goat farmers from Minnesota and surrounding states. Extension agents, veterinarians, Vo-Ag instructors, and others interested in dairy goat management.

NOTE: Session II B is designed for those just starting with dairy goats.

FEE

\$11.00 – includes proceedings and refreshments
\$ 4.00 – for each additional family member
\$ 4.25 – lunch (*optional*)

SPONSORS

University of Minnesota

- Agricultural Extension Service
- Office of Special Programs
- College of Veterinary Medicine
- Department of Animal Science
- Department of Food Science and Nutrition

in cooperation with:

Minnesota Dairy Goat Association

PROGRAM

a.m.

SESSION I

- 8:00 *Registration*
View films on goats and see goat equipment display
Presiding, Don Otterby
9:00 Herd Health and Breeding - International Comparison – *Sam Gus*
10:00 Housing Requirements – *Robert Appleman*
10:45 *Break*

SESSION II A

- 11:05 Abscesses – *Terrance O'Leary*
11:50 Gastric Intestinal Disorders – *Dave Sherman*
12:30 *Lunch*

p.m.

Presiding, Robert Appleman

- 1:30 Reproduction Management – *Sam Gus*
2:15 Herd Health Panel – *S. Gus, T. O'Leary, D. Sherman, and D. Thompson*
3:00 *Break*
3:20 Goat Milk Production and Utilization – *Harold Johnson and Vince Maecky*
4:20 The Best Mating for My Doe - Selecting the Best Buck for Maximum Improvement – *David Kowalski*
5:00 *Adjourn*

SESSION II B

Presiding, Don Otterby

- 11:05 Selection of Dairy Goats – *Doug Thompson*
11:50 Managing Your First Goat - Pitfalls That Lead to Poor Health – *Sam Gus*
12:45 *Lunch*
1:45 Homesteaders - Product Possibilities: Skimmed Milk, Butter, Cottage Cheese, and Yogurt – *Tom Hicks*
3:20 *Break*
3:40
5:00 *Adjourn*

Goats!

If you know of anyone who might be interested in attending the 2nd Annual Dairy Goat Conference, please pass the information in this brochure along to them.

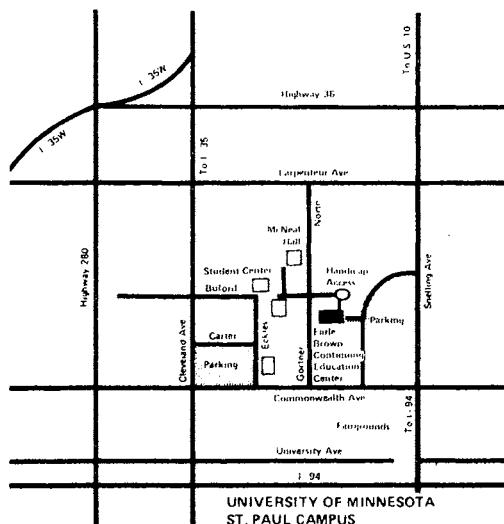
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2ND ANNUAL DAIRY GOAT CONFERENCE

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HERD HEALTH AND BREEDING--
AN INTERNATIONAL COMPARISON

Samuel B. Guss, V.M.D.
Professor Emeritus
Veterinary Science Extension
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When I studied this topic assigned to me, I had mixed feelings about how I could best handle it. Let me state from the beginning that I shall attempt to communicate what I have seen in my travels in both the agriculturally underdeveloped and the agriculturally advanced countries of the world. I hope to give you an appreciation of the goat in both these kinds of agriculture.

In the developing countries of the world: In Africa, the Middle East, South America and Asia, goats are a very important segment of primitive agriculture. In these countries, goats are of top importance producing milk, meat and hides which support the human population and furnish some foreign exchange. Goats are the principal animals of nomadic people and those who eke out a living grazing animals on extensive ranges surrounding their villages.

In the Middle East, goats are herded by children and women in the bleak countryside. Over the years, foreign observers have credited the animals with destruction of the habitat. Forests, pastures and rocky hillsides bear testimony to almost complete destruction by large numbers of goats. However, it seems more logical that the goats themselves cannot shoulder the blame for the destruction, rather, their owners' management and control of goat numbers deserves scrutiny.

In Turkey, for example, the entire agricultural economy suffers from a system in which the largest possible number of surviving, rather than producing animals, is maintained. Cattle and sheep are the dairy animals of Turkey and effort is made to supply them with the best pasture available and health care via veterinary service. The average Turkish cow produces 700 liters of milk in a three and a half month lactation; the average milking sheep produces 70 liters of milk in the same length lactation and the average goat produces a kid weighing about 50 lbs. each year.

Cows and sheep are given the benefit of government veterinary service to control a horrendous array of diseases. The goat, however, receives little, if any, stored feed and no veterinary care. "Allah" feeds the goats and goat disease problems are relegated to the will of "Allah". That state of mind is prevalent through the Middle East and Northern and Eastern Africa.

After centuries of little but protection from predatory animals, goats have become adapted to lives of semi-starvation and bare survival. Where cattle and sheep are continually subjected to regular vaccination programs designed to insure their survival, goats have had little or no veterinary attention and they have developed resistance to disease and a fantastic ability to survive where other domestic animals die of disease and starvation. As a result, numbers of goats may exceed the capacity of existing rangeland to support them, and the poor goat gets the credit for destroying vast areas of those countries.

In the autumn of 1977, I spent a month on a World Bank assignment in Turkey. I learned there from a Turkish ministry of Agriculture official about a program in Iran which Turkey watched with great interest. Foreign agricultural experts had told the Iranian government, as their predecessors had told the Turkish government, that goats were responsible for the destruction of grazing lands and the starvation of sheep and cattle. So goats were exterminated from an entire province of Iran and it became illegal to own or herd goats. Within ten years, shrubs and bushes of all sorts appeared in the meager sheep and cattle pastures crowding and shading out the grass species there. Available grazing for cattle and sheep began to disappear and those species suffered for lack of food in the returning goat pasture.

It is clear that management of all grazing or browsing species of plants requires several species of animals with diverse preferences for the greatest production. Poor management is the cause of the plight of the Third World for failure to provide the necessary animal protein and animal fibre for the well being of rapidly expanding human populations.

I have read and reviewed a number of government and church charity proposals for improving human welfare via improvement of animal agriculture. In my humble opinion, programs to survey, identify and combat diseases of goats in these countries should not have high priority. What goats, cattle, sheep, camels and buffalos in these countries need is better nutrition which will raise them from surviving animal populations to producing animal populations.

Goats in the Third World, like all the other species mentioned above, need food rather than medicine. Programs to feed domestic animals in the developing countries present a tremendous challenge for agronomists, soil scientists and nutritionists. Veterinary medicine can only make worthwhile contributions to the goat populations of the developing countries after goat husbandry has progressed from a survival situation to a producing situation. The advanced agricultural countries of the world have the technology, the animals and the basic science necessary to improve the meat and milk supply of the developing countries.

Dairy goats in the United States, the United Kingdom and Australia are, for the most part, maintained in an intensive zero pasture or dry lot situation. There is little evidence that goat milk production is becoming a serious commercial enterprise.

In the United States, the number of registered goats per owner has not increased above five animals in the past fifteen years. The number of commercial goat dairies producing 200 or more quarts of fluid milk daily for legal sale is less than 25 for the entire country. However, production testing, genetic improvement and other basis for founding a viable goat milk industry are active and expanding programs now underway which could provide for a goat milk production industry able to compete with the dairy cow milk industry.

Veterinary medicine in the advanced agricultural countries of the world has at last recognized the goat and its potential. In my visits to various veterinary schools in the United States and Canada, I have been impressed with the keen interest in dairy goats exhibited by both students and faculties.

In France, the goats' milk cheese industry has made rapid strides in the past ten years from a cottage industry to a large modern dairy enterprise. The technology for improving the dairy goat industry in the advanced countries of the world is already at hand and expanding rapidly.

The necessary competence to improve goat milk and goat meat production in the developing countries will be available by the time agronomic programs to increase forage production are established. The goat, an animal closely associated with man since the dawn of agriculture may finally be the animal to help developing countries out of subsistence agriculture into producing agriculture, capable of providing human and animal populations with more excellent quality food.

HOUSING THE GOAT HERD

R. D. Appleman
Extension Dairyman
University of Minnesota

Before one buys a goat he should give some consideration to housing the animal. Because of the long and sometimes "hard" winters in Minnesota and Wisconsin, the question of "what is adequate housing" is more important than it is in some other states.

Dairy goats do not need fancy housing. Many older buildings can be adapted to cut costs. Those intending to remodel a building for housing goats or build a new one should first visit several goat dairies, inquire about the strengths and weaknesses of their housing systems, then contact the local county agent regarding insulation and ventilation needs.

TWO TYPES OF GOAT HOUSING

There are two main methods of housing dairy goats: (1) shed type or loose housing, and (2) tie stalls or individual confinement. Some use a combination system, stalls for milking does and loose housing for the yearlings and kids.

Loose housing has many advantages and some disadvantages. These may be summarized as follows:

| Advantages | Disadvantages |
|--|--|
| 1. Exercise resulting from the freedom is desirable. | 1. Boss goats, especially when horned, may cause injury. |
| 2. Daily handling of manure is minimal or possibly eliminated. | 2. There will be much riding when a doe is in heat. |
| 3. Manure pack, when kept dry, provides heat and comfort. | 3. More bedding is required. |
| 4. Building construction and maintenance costs are minimized. | 4. A separate milking parlor is an absolute requirement. |

Dirt pen floors are preferred over cement. At least 15 sq. ft. of bedded area should be provided for each goat. The floor should be bedded regularly with dry straw, wood shavings or ground corn cobs to absorb moisture. Some dairy-men construct feeding stanchions at the feed bunk. Stanchions permit one to control intake of feed grains. At least 10 ft of vertical space from floor to ceiling rafters is desirable to facilitate cleaning with a tractor and front-end loader.

Goats prefer to be outside some on nice days, even when it is cold. The outside exercise lot should provide a minimum of 25 sq. ft. of space per animal, be well-drained and properly fenced. Goats like to lean on the fence to greet visitors. A 6-inch woven wire fence (4 to 5 ft. high) is adequate. Some goats will get out of nearly any fence. In this case, place an overhanging wire from 10 to 12 inches from the inside and top of the fence, supported by

offset pieces nailed to the posts. This wire may be electric, although barbed wire is usually adequate. Put snap hooks on all gates. Goats are able to unlatch other types of hardware.

Confinement housing also has several advantages and disadvantages, namely:

| Advantages | Disadvantages |
|---|--|
| 1. Less bedding is used. | 1. Building costs are increased because of concrete floors, and individual pens. |
| 2. Individual pens permit more attention to the needs of each animal. | 2. Individual pens are more labor intensive. |
| 3. It is easier to show animals to prospective buyers. | 3. Poorly ventilated housing is conducive to more health problems. |
| 4. An outside exercise lot is not an absolute requirement. | |

Individual pens should be about 6 ft square, and equipped with a hay feeder, grain box and water pail, all attached to the pen wall. The pen floor may be constructed to slope 3 or 4 inches toward a gutter cleaner.

VENTILATION AND INSULATION

Ventilation is a continuous process to remove moisture and other contaminants given off from the breath of animals from inside the building, provide fresh air for the animals, remove odors and gases from animal waste, provide a satisfactory minimal temperature in winter, and maintain a summer temperature inside the barn that is approximately the same as outside.

A "system" is required to bring fresh air into the building, distribute it evenly, and remove it. This system is completely different for the 2 types of housing environments, "cold" and "warm".

In "cold" housing, natural convection forces move the air, and properly located adjustable inlets provide distribution and volume control. In "warm" housing, a mechanical ventilation system, either exhaust or pressure, is used. Exhaust systems are the more popular in Minnesota. Air distribution is provided by properly located inlets and exhausted via 2 or more mechanical fans, at least 1 running continuously.

Cold housing is becoming more popular in Minnesota where manure pack "bedded" systems are used because of increasing energy costs and simplicity in providing a healthy environment. The "cold" unit is mainly a shell to keep rain and snow off the animals and to protect them from wind.

Sufficient air movement must be provided to prevent fogging and excessive condensation beneath the roof. Satisfactory ventilation can be provided through a continuous open ridge (minimum 4-inch width with no screen over the opening) together with suitable wall openings. A 1-inch thickness of rigid insulation is recommended under the roof to reduce condensation in winter and heat gain in summer.

Inlets in the wall of the building need to be at least 2 sizes, large openings for summer and much smaller ones to provide air movement in winter. Summer

air inlets are often 3 x 6 ft or 4 x 8 ft doors, which may be adjusted during changing weather. Winter air inlets are commonly under overhangs and may be equipped with hinged doors that can be closed during snowstorms.

Since "cold" barns may get below 32° F in winter, depending on the number of animals housed, it is recommended their use be limited to loose housing systems whereby heated, insulated waterers may be provided for each group of goats.

Warm housing involves a mechanical ventilation system in which winter temperatures are maintained at 40° F or above. To control temperature and moisture, the following items must be provided:

1. insulation in the walls and ceiling (insulation R values in the walls of at least 14, ceilings should have an R value of 23 or more),
2. at least 2 exhaust fans (1 running continuously and 1 thermostatically controlled),
3. adjustable air inlets,
4. limited door and window openings, and
5. supplemental heat if needed.

In Minnesota, adequate insulation can usually be obtained by placing 3 1/2 inches of blanket insulation in the walls and 8 inches of fill insulation in the ceiling. All insulation must be protected with a tight vapor barrier installed on the warm side. The thermal resistance (R values) of the more common insulation materials available are shown in Table 1. These may help you select the insulation that best meets your needs.

The ventilation system consists of: 1) a fresh air inlet system and 2) the exhaust system. Each is equally important. A fundamental requirement of any successful ventilation system is that at least 1 exhaust fan run continuously. A minimum of 4 air exchanges per hour is recommended.

Total winter ventilation capacity, including the thermostatically controlled exhaust fans, should approach 15 air exchanges per hour. A practical summer ventilation rate is one air exchange every 2 minutes, or 30 air exchanges per hour.

An Example: consider a barn 20 ft wide, 38 ft long, with an 8 ft ceiling.

1. Total cu. ft. capacity = length x width x height
= 38' x 20' x 8'
= 6080 cu ft
2. To obtain 4 air exchanges per hour, divide total cu. ft. capacity by 15 minutes, e.g.:

$$\frac{6080}{15} = 405.3 \text{ cfm (cu. ft. per min.)}$$

Thus, a 400 cfm fan running continuously would be appropriate.

3. To obtain 30 air exchanges per hour, divide total cu. ft. capacity by 2 minutes, then subtract 400 cfm (supplied by the continuous fan), e.g.:

$$\frac{6080}{2} = 3040 - 400 = 2640 \text{ cfm}$$

Thus, two 1300 cfm fans, thermostatically controlled, would be appropriate. These could be set at different settings, so only one would operate intermittently in winter.

A fresh air inlet system must be provided for satisfactory ventilation. This is frequently overlooked or ignored, especially when attempting to use older buildings, and is the most common cause of unsatisfactory ventilation performance.

A slot inlet system permits adequate distribution of small amounts of air in many places. It can easily be built into the barn during construction by making an adjustable slot at the junction of the walls and ceiling, except for a distance of 4 ft on either side of each exhaust fan. Air is drawn into the barn through these inlets by the exhaust fans.

This slot should be 1-inch wide for winter use. Note: if all fans are placed along one side of our 36 ft long "example" barn, then a 1-inch slot along the other side will provide 3 sq. ft. of air inlet. Air velocity entering the building will be 133 ft per minute ($400 \text{ cfm} \div 3 \text{ sq. ft.}$) or 1.5 miles per hour, enough to prevent a back draft (excess of 100 ft. per minute is recommended), but not enough to be considered an excessive draft.

During the fall and spring months, when one of the thermostatically controlled fans will be operating much of the time, the slot inlets should be opened to a width of 1 1/2" to 2" to allow more air to enter. This will prevent a vacuum from forming within the building, thus limiting exhaust fan performance.

In older, existing buildings, it is often more practical to construct ceiling intakes rather than remodeling to make a slot. In our example where 3 sq. ft. of slot intake was recommended, one could locate 6 ceiling intakes (each 0.5 sq. ft. capacity) to draw air from the attic or hay loft. These should be equally spaced (about 5 ft apart) along the ceiling and about 5 ft from the wall opposite the exhaust fans. Additional ceiling intakes for summer use may be placed in the ceiling closer to the exhaust fans, but remember to close these during the winter months.

Remember that satisfactory ventilation in poorly insulated older buildings of wood construction or those having stone or concrete block walls, single windows, and loose fitting doors is often an impossible task. Often one or more fans are installed in an attempt to improve conditions with mediocre results. As a consequence, air enters through available openings around loose fitting doors and windows, hay chutes, cracks, etc. The results often times are excessive drafts and/or decreased fan performance. In either event, the result is one of damp and wet facilities, diseased animals and dissatisfaction.

RULES FOR LOCATING EXHAUST FANS

1. In barns where animals are maintained all year on a manure pack, space the fans uniformly in the south or west wall to provide for best air flow across the barn in summer.
2. Locate all fans at least 10 ft away from doors or other openings.
3. Locate the thermostats controlling the high capacity fans near the center of the building and at a height of 5 to 6 ft. Do not place thermostats on an outside wall.
4. In winter, attempt to maintain the temperature at 40 to 45° F. Remember, the higher the inside temperature, the more difficult it is to control moisture during cold weather.
5. Do not locate fans near pens of kids or yearlings in an attempt to draw heat to this area from areas where older animals are kept. Aerosol contaminants from the older animals may cause younger ones to have more disease problems.
6. Wet corners often can be dried up by admitting fresh air. In parts of the stable where fewer or smaller animals are housed, added insulation, and possibly heat, may be required.
7. Install all fans near the ceiling. In barns with limited insulation, build a duct 12 inches deep and as wide as the fan frame around the continuously running fan to draw cooler air from near the floor in winter. Locate a door in the duct directly in front of the fan. Keep the door closed in winter, open in summer.
8. If the continuous fan has too much capacity and creates too much air flow, place a damper near the bottom of the duct to reduce air movement in extremely cold weather.

Table 1. Thermal resistance values of commonly used materials.¹
Values do not include surface resistances

| Material | Thermal resistance (R) per inch thickness | for thickness as manufactured | Material | Thermal resistance (R) per inch thickness | for thickness as manufactured |
|---|---|----------------------------------|--|---|----------------------------------|
| Batt or blanket insulation | | | Ordinary building materials | | |
| Glass wool, mineral wool, or fiberglass | 3.0-3.7 ² | | Face brick | .11 | |
| 3-3½ in. batt | | 11 | Concrete, poured | .08 | |
| 5½-6½ in. batt | | 19 | Concrete block, 8 in. | 1.04 | |
| Fill-type insulation | | | Concrete block, 8 in. with cores filled | 1.93 | |
| Glass or mineral wool | 2.2-3.6 ² | | Light weight concrete blocks, 8 in. | 2.18 | |
| Vermiculite (expanded) | 2.20 | | Light weight concrete blocks, 8 in. with cores filled | 5.03 | |
| Shavings or sawdust | 2.20 | | Plywood | 1.25 | |
| Cellulose products (milled pulverized paper or wood pulp) | 3.70 | | Plywood, 3/8 in. | .47 | |
| Rigid insulation | | | Plywood, 1/2 in. | .63 | |
| Insulating board | | | Hardboard, medium density | 1.37 | |
| Sheathing, regular density ½ in. | | | Plasterboard 3/8 in. | .32 | |
| Sheathing, regular density 25/32 in. | | 1.25 | Plasterboard 1/2 in. | .45 | |
| Expanded polystyrene, extruded, plain | 4.00 | | Cement asbestos board | .25 | |
| Expanded polystyrene, moulded beads | 3.57 | | Lumber (fir, pine, and similar soft woods) | 1.25 | |
| Expanded polyurethane (aged) | 6.25 | | Asphalt shingles | .44 | |
| Glass fiber | 4.00 | | Wood shingles | .94 | |

ABSCESSES IN GOATS

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I. INTRODUCTION

The problem of various types of abscesses in caprine medicine may be the largest single problem presented to most goat owners and practicing veterinarians. In our Necropsy Service at the University of Minnesota, we seldom examine a mature goat which does not have abscesses of some kind, although not all of these pose significant clinical problems.

In this brief presentation, I would like to share with you some observations gleaned from my own experience in the necropsy room, from the experiences of goat owners and practicing veterinarians, and from a reading of the current literature.

II. TYPES OF ABSCESSES AND ETIOLOGICAL AGENTS

One diagnostic and therapeutic problem faced by owners and veterinarians alike is that there are many different types of abscesses, often appearing alike when viewed grossly. Although the great majority of abscesses seem to be caused by two common bacterial agents, which we will discuss in some detail, I will mention other possible agents.

Another problem in diagnosis is that agents may not be easily recoverable from the old, chronic lesions and, thus, bacteriological culture attempts may be negative. We will discuss some gross and microscopic (histopathological) characteristics which aid the diagnostic pathologist and clinician in making a differential diagnosis.

A third problem in diagnosis and therapy is that many goats have internal as well as external abscesses. These internal lesions are more difficult to find and diagnose and much more difficult to treat than are external abscesses. There has been a recent increase in attention paid by veterinary diagnosticians and researchers to this problem in both sheep and goats.

Caseous Lymphadenitis (Pseudotuberculosis). This type of abscess constitutes the "major disease of dairy goats in the United States" according to Dr. Guss and most other authorities. The bacterial agent is a small, Gram-positive coccobacillus called Corynebacterium ovis.

The disease begins when the young goat ingests organisms with feed or suffers a skin wound which becomes contaminated. Some authorities believe that direct contact to unbroken skin by contaminated bedding or other infected goats may also cause infection. The organisms move along the lymphatic vessels to local lymph nodes where they cause a

lymphadenitis (lymph node infection) which at first produces pus (purulent lymphadenitis) but later produces a thick greenish-white, cottage cheese-like, necrotic exudate (caseous lymphadenitis). Sometimes the exudate resembles dried-out tooth paste. This process may take several years so that abscesses usually do not show up until goats are more than one year of age. This material may appear to be concentrically layered (laminated) in chronic lesions.

Abscesses frequently show up in all of the superficial (easily felt) lymph nodes of the goat's body, especially around the throat (parotid), in front of the shoulder blades (prescapular), and above the udder in the flanks (superficial inguinal). Internally, the lymph nodes in the chest (mediastinal), around the lungs (bronchial), and in the tissue that suspends the intestines (mesenteric) are commonly involved.

Although these abscesses usually destroy the lymph node, a tough fibrous capsule usually forms to contain them unless they are torn open accidentally or are incised during treatment.

Superficial abscesses sometimes rupture, thus spreading the infection. Internal abscesses often cause pressure on nearby organs and thus lead to symptoms such as chronic cough or difficult breathing. Non-specific "wasting away" of goats with internal abscesses is also attributed to internal abscesses.

When the clinician or pathologist looks at lesions caused by C. ovis in the live animal or at necropsy, the location of lesions, the type of exudate and the type of capsule formed are important. Attempts are often made to smear a portion of the exudate onto a glass slide and stain it with one of the special stains which detect Gram-positive bacteria. A swab of the exudate may be cultured to actually prove which organism or organisms can be recovered. Tests of blood serum to measure antibodies to infection have not been very successful.

A differential diagnosis of C. ovis lesions in goats includes:

1. Other exudate-forming bacteria, such as Corynebacterium pyogenes.
2. Tumors of the lymph nodes or tumors which have spread to the lymph nodes, such as lymphosarcoma (leukemia).
3. Other chronic wasting diseases, such as Johne's Disease (para-tuberculosis), chronic pneumonias, and chronic arthritis.

Therapy for abscesses of this type is simple and often effective for individual lesions. Incising, draining, flushing, and packing the abscess commonly leads to healing. Systemic (injected) antibiotics are often not effective if abscesses are not incised due to the thick protective capsule. The major problems with local therapy are that it is expensive, that a new crop of abscesses often springs up just as the old abscesses

are healing, and that internal abscesses are difficult or impossible to treat.

Prevention is the progressive way to deal with caseous lymphadenitis. In herds with infected animals, affected animals should be segregated, treated, and all exudates, dressings and bedding burned or buried. Baby kids should be isolated from their dams and fed milk from non-infected does or colostrum followed by milk replacer. Autogenous vaccines custom-made from pooled herd organisms are recommended by Dr. Guss and some authorities. Animals which do not respond to therapy should be eliminated. Replacement animals should be generated from within a known clean herd.

C. ovis is capable of infecting humans, although this is apparently uncommon. Care should be taken to avoid unnecessary contact with the lesions or their exudates during handling of affected goats.

Purulent Abscesses. This type of abscess may be caused by many organisms including Corynebacterium pyogenes, Streptococcus, and Staphylococcus.

The most commonly found organism is C. pyogenes, which is another Gram-positive coccobacillus that can also cause generalized abscesses in many tissues including the lymph nodes. Pneumonia and mastitis are also commonly caused by this organism.

The spread of this organism is probably much like that of C. ovis except that the abscess produced contains a yellowish-white, creamy, mayonnaise-like exudate. The exudate is often foul-smelling.

A special form of purulent abscesses of this nature is the "udder impetigo" or multiple cutaneous abscesses scattered over the skin of the udder and teats. Apparently C. pyogenes invades small breaks in the skin and causes these small, painful, draining abscesses. Staphylococcus may also be involved.

A differential diagnosis of purulent abscesses should include:

1. Early stages of C. ovis infection.
2. Attempts to determine, by smear and culture, which of the purulent organisms is involved. Multiple isolations are common.
3. Pox virus infections, such as contagious ecthyma, which have become secondarily infected by bacteria.

Therapy and prevention recommendations are similar to those for C. ovis and involve sanitation, isolation of affected animals, and antibiotics. C. pyogenes may infect humans but apparently seldom does so.

III. SUMMARY

There are two major bacterial agents responsible for the most commonly found abscesses in North American goats:

1. Corynebacterium ovis, which causes a cottage cheese-like, necrotic abscess with a thick fibrous capsule in both external and internal lymph nodes.
2. Corynebacterium pyogenes, which causes a mayonnaise-like, necrotic, purulent abscess of lymph nodes and other soft tissues.

It is C. ovis caseous lymphadenitis which is the more serious condition and which may be the most important condition affecting goat herds in North America.

Infection by this organism is difficult to detect by any means other than direct smear or culture. Reliable skin tests, gel-diffusion tests or blood serum tests have not yet been developed.

Therapy of external abscesses caused by this organism consists of excision, drainage, and antibiotics. This may be expensive and does not deal with the problem of internal abscesses or reoccurrence of more abscesses elsewhere in the animal.

Internal abscesses cannot be treated well by systemic antibiotics and appear to be a contributory factor in chronic wasting syndromes of mature goats.

Prevention of caseous lymphadenitis in goat herds may be achieved by isolation and treatment of affected animals, elimination of non-responding animals and replacement with disease-free kids.

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GASTROINTESTINAL DISORDERS OF GOATS

David M. Sherman, D.V.M.

Digestive system disorders make up a large segment of the disease problems in goats for which veterinary attention is required. The purpose of this discussion is to highlight the more common digestive disorders of goats so that you can

- a) Recognize the signs of the disease.
- b) Follow the appropriate course of therapy with your veterinarian.
- c) Make appropriate management changes to lessen the occurrence of disease.

Colibacillosis (Kid Scours)

Definition

- a) An intestinal infection with the bacteria, E. coli.
- b) The most likely cause of diarrhea (scours) during the first week of a kid's life.
- c) A disease which if improperly treated can result in death loss due to dehydration.

Clinical Signs

- a) Non bloody diarrhea
- b) Dehydration - recognized by a dull appearance, sinking in of the eyes, and poor elasticity of the skin when pinched and released.

Treatment

- a) Take kids off milk at the first sign of scours.
- b) Feed commercially available electrolyte solutions

available for calf scours. Mix according to directions and feed one pint three times a day for two days.

- c) If diarrhea stops, bring back on milk slowly, gradually increasing to full feed over the next three days.
- d) If diarrhea persists, consult your veterinarian for possible bacterial culture and antibiotic sensitivity testing, intravenous fluids, and appropriate antibiotics.
- e) Note: Most E. coli are resistant to readily available over the counter scour medications. More scours will be cured with oral fluid electrolyte therapy than with scour pills!

Prevention and Control

- a) Make sure that newborn kids get colostrum within the first six hours of life. Keep frozen colostrum available for orphan kids. Dip navels in iodine.
- b) Clean maternity pens between kiddings. Keep dry with plenty of clean straw.
- c) Don't overcrowd kids. Keep kid pens clean and dry and well bedded.

Coccidiosis

Definition

A bloody scours affecting mostly young kids due to protozoan parasites of the intestinal tract.

Clinical Signs

- a) Because the organisms must undergo maturation before causing disease, coccidiosis will not be seen before a week to ten days of age and can cause serious problems

usually up to four months of age.

- b) Signs may range from soft stools to severe bloody diarrhea with rapid dehydration and death.
- c) Eggs (oocysts) can be observed in the feces when prepared correctly for microscopic examination.

Treatment

- a) Affected individuals can be treated orally by drenching with an effective sulfa drug or Amprolium for five days.
- b) For herd problems, these same medications can be administered in the water supply at therapeutic or preventive doses.

Prevention and Control

- a) Overcrowding, poor sanitation and fecal contamination of feed and water supplies aggravates this problem.
- b) Spread kids out in pasture when possible.
- c) If confined, change bedding frequently and keep dry.
Limit the number of kids per pen.
- d) Use keyhole feeders to avoid contamination of feed with feces. Keep water fresh and clean.

Enterotoxemia (Overeating Disease)

Definition

A serious, often fatal, bacterial disease caused by toxins released by Clostridium perfringens, types C and D. The disease affects animals of all ages, but is most often acutely fatal in young kids. Overfeeding or sudden changes in feed or feed practices triggers this condition, causing increased toxin production in the gut.

Signs

- a) Kids which appeared normal the previous evening may be found dead the next morning. Other kids, still alive may show signs of convulsions and paddling.
- b) Older animals may demonstrate acute death, severe nervous signs or depression and diarrhea.
- c) Post mortem examination may reveal increased fluid around the heart, hemorrhage in the intestinal wall, and pulpy kidney. Urine taken from the bladder may show increased glucose.

Treatment

- a) Administration of antitoxin with a resulting improvement in clinical signs will help confirm the diagnosis.
- b) Repeated administration of antitoxin may carry the affected individual through to recovery.
- c) Reminitorics may be of some benefit to reduce toxin absorbtion and help clean out the g.i. tract.

Prevention and Control

- a) Fortunately vaccination (bacterin-toxoid) is available for Clostridium perfringens types C and D.
- b) Vaccinating does two to four weeks prior to kidding will increase the protection kids receive from colostrum.
- c) Kids should be vaccinated at three to four weeks of age when colostrol protection is wearing off and boosted two weeks later.
- d) All animals in herd should be boosted twice annually.
- e) All feed changes should be approached cautiously. Make alterations in feedstuffs or feeding regimens slowly

over long periods of time to minimize the chance of intestinal upset.

Grain Overload

Definition

A potentially fatal disease of older goats resulting from sudden large intakes of carbohydrate rich feeds. Fermentative changes in the rumen result in a severe generalized acidosis which requires immediate correction. Even if corrected quickly, secondary complications may result in loss of the animal. These include destruction of the rumen wall, liver abscesses and founder (laminitis).

Signs

- a) A shock like condition may be observed in association with apparent bloat or diarrhea or both.
- b) A fermented "beery" odor may be noted on the breath.
- c) This condition may be easily confused with enterotoxemia. It is important to sample the rumen contents by stomach tube and check the pH (Acidity). If under 4.8 acidosis is present and must be treated.

Treatment

- a) Two to four ounces of baking soda dissolved in water should be given right away as a drench to help neutralize the rumen acid.
- b) If you are skilled in the technique, a pint of mineral oil can be given via stomach tube to slow down the rumen fermentation process.
- c) A veterinarian should be called to evaluate the seriousness of the situation. In advanced cases, surgical

emptying of the rumen may be required to save the goat. In addition, intravenous fluids and antibiotics may be required to correct the acidosis and avoid complication.

- d) Restrict water intake! Water in the rumen will promote fermentation.

Prevention and Control

- a) Since the disease is associated with excessive grain ingestion, grain stores should be kept where goats do not have access. If a locked feedroom is not available, use bins or cans with tight fitting lids.
- b) Avoid sudden increases in concentrate in the ration. Make changes gradually over a number of days.
- c) Watch out especially for "boss" goats which may consume all the grain intended for the entire group of animals in a pen. These are good candidates for grain overload.

Bloat

Definition

A potentially fatal condition resulting from excessive build up of gas in the rumen. This condition is associated with lush forage feeds and pastures, especially those containing alfalfa and other legumes.

Signs

- a) If a herd problem, some animals may be found dead shortly after being placed on pasture or fed high moisture leguminous forages. Others will show a marked swelling in the abdomen on the left side behind the rib cage.

Treatment

- a) Since persistent, increasing pressure in the rumen may result in death, release of gas is critical.
- b) Passage of a stomach tube may release gas if it is free. Frequently, though, no free gas is present. Rather, gas is distributed through the liquid in the rumen resulting in a froth not unlike beaten egg whites in consistency. In this situation, an antifrothing agent must first be administered. These can be obtained from your veterinarian and kept on hand for emergencies. In a pinch, vegetable oil from your kitchen can be given as a drench or through a stomach tube.
- c) If none of these options are available to you, call the veterinarian. In the meantime, tie a handkerchief or piece of rope around the goat's lower jaw (through the mouth). This will promote chewing and saliva production which may promote belching of gas and reduction of froth. Walk the goat to promote rumen motility.

Prevention

- a) If goats are put out to pasture, gradually increase the time outside starting with an hour the first day, two hours the next, etc. If bloat has not been a problem or if pastures are dry and/or non legume, this degree of caution may not be necessary.
- b) Try not to feed your most recently bailed hay or mix it with older hay. If new hay is wet, goats may selectively pick out the leaves of alfalfa in sufficient quantities to become bloated.

Johne's Disease (Paratuberculosis)

Definition

Johne's Disease, caused by the bacteria, Mycobacterium paratuberculosis, is a slowly progressing chronic disease resulting in loss of appetite, wasting, and death. Diarrhea may be seen in the final stages.

Signs

- a) Animals over two years old are affected although infection occurs when they are kids.
- b) Progressive weight loss over a period of one to three months is observed.
- c) Appetite diminishes and after a long period of weight loss, diarrhea may be observed.
- d) The disease is difficult to distinguish from parasitism or internal abscesses.

Treatment

- a) No treatment is known.
- b) The first important step is to confirm that the disease is present in your herd.
- c) Animals dying after a period of weight loss should be submitted for necropsy. If the whole animal cannot be brought to a diagnostic lab, have your veterinarian send in the terminal ileum, ileo cecal valve, ileo cecal lymph node, and proximal colon for special acid fast staining.
- d) If the animal has Johne's disease, discuss the desirability of performing bacterial culture from feces on all your adult goats.

Prevention and Control

- a) This is a difficult disease to control because most infected animals are carriers not showing clinical signs.
- b) Culture of feces may identify carrier animals but the culture technique is very slow (three months for results) and some animals may be missed.
- c) Other diagnostic tests are being developed but are not 100% effective at this time.
- d) Since animals are infected as kids, kids should be raised away from adults, who shed the organism in their manure.
- e) Udders should be thoroughly cleaned before taking colostrum for kid comsumption.
- f) Ask before buying goats. Some herds are known to have a Johne's problem. If is best not to buy trouble if you can avoid it.

Parasitism

Definition

Gastrointestinal parasitism continues to be the major digestive problem of goats. Parasites do their damage by competing with the host for nutrients, producing anemia, and weakening the goat so that other disease problems are likely to take hold.

Signs

- a) Unthrifty appearance with rough hair coat and scaly skin. Weight loss.
- b) Check the gums and inside of the eyelid. In heavily parasitized animals, resulting anemia will cause the

gums and eyelids to become pale white instead of the normal pink.

- c) Bring fresh fecal specimens to your veterinarian for egg checks. The types of worms present in your herd can be identified by microscopic examination.

Treatment

- a) Worms can be effectively controlled with frequent use of the new broad spectrum wormers such as Thiabendazole and Levamisole (don't use the latter in young kids and does in late pregnancy).
- b) A false sense of security can be obtained using the older wormers such as Piperazine and Phenothiazine. These preparations only kill a limited number of parasite species and resistance is known to occur.
- c) At the very minimum, worm the herd in the spring and at least once again in the summer when worm populations are the highest.
- d) The addition of extra wormings can be decided on the basis of clinical signs, or egg checks.

Control

- a) Avoid overcroding of pens and pastures.
- b) Divide pasture land and rotate goats periodically to avoid build up of eggs and to allow the sunshine to reduce egg burdens.
- c) Use keyhole feeders to avoid fecal contamination of feed.

REPRODUCTION MANAGEMENT

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In temperate regions of the world, goats are seasonal breeders. They reproduce in that time of the year when daylight hours are diminishing. In the tropics, however, goats usually produce kids three times in a two year period. As goats are kept at increasing distance from the equator, the breeding season becomes more sharply defined. In northern Florida, the breeding season starts about the middle of August and continues well into February. In Maine, the breeding season begins in mid-September and continues until mid-January.

There is a definite difference in breeding season between breeds of goats. The Swiss breeds are much more rigidly seasonal in their breeding habits than are Nubians or Mexican goats. French Alpine goats in northern United States, and to a lesser extent, Toggenburgs and Saanens, usually begin to show heat in September and the bucks show intense sexual activity about that time.

A long time owner of a large herd of French Alpines told me recently that his goats breed very well from early October until the end of December. A few females breed several weeks earlier or later, but the breeding season for the herd is sharply defined over a two to two and a half month period.

Nubians, however, have a longer breeding season which usually begins as much as one month earlier and ends as much as one month later. Seasonal breeding tendency has been one of the peculiar herd problems which makes it very difficult to prevent great seasonal differences in herd milk production.

Hornlessness and Infertility This is a genetic situation which should be understood by every goat breeder. While it would seem to be desireable with dairy goats as it is with cattle and sheep, to have animals which are hornless, in dairy goats, natural hornlessness is genetically associated with infertility. Hornlessness is a dominant transmitted characteristic and it is expressed in two ways:

When one parent of a kid is horned (or disbudded) and the other parent is homozygous hornless (polled), heterozygous offspring resulting will be hornless, but they will have frontal protuberances where their horns ought to be. Occasionally, you will see one with very small scurs. When heterozygous parents produce kids, they are born in the regular mendelian expectation: a ratio of 1 horned: 2 heterozygous hornless: 1 polled homozygous hornless.

Truly polled homozygous hornless goats have smooth round heads with the hair radiating from the center like spokes from the hub of a wheel. Homozygous hornless females may have incidence of infertility with genital hypoplasia as high as 20 percent. All homozygous hornless males are infertile with testicular hypoplasia (undeveloped soft testicles).

Perhaps the most important single thing in reproduction management of goats is to select breeding animals so that their offspring will be fertile. Dr. Ricordeaux, French geneticist, says that the problem can be successfully handled easily if goat breeders take the precaution that one parent of every kid born into the herd was born with horns.

The genetic problem of hornlessness and infertility occurs in all breeds of goats. Ignoring it can bring about disaster. For example, I am aware of a small herd of dairy goats in which replacement bucks were selected because they were hornless. After a period of about 10 years, there were seven males and 16 females in the herd. None of the males were fertile, and about 50% of the females were sterile. Most of them had congenital genital hypoplasia (infantile genital organs).

Regulation of the Breeding Season (to prevent very low winter milk output and excessive milk production during spring and summer months) - Dr. Corteel of France, and others, have used injections of progesterone followed by pregnant mares' serum injections to successfully breed does during the normal anestrus (lack of heat) period. Some work has been done by Dr. Barker of Guelph, Ontario, and others, using vaginal tampons containing synthetic progesterone. The tampons are allowed to remain in the vaginas of females for at least a three week period. The tampons are removed and pregnant mares' serum, or other estrogen, administered by intramuscular injection.

Does usually show heat after 72 hours and conceive at nearly normal rate on the following heat 18 to 21 days later. The research on hormonal regulation of heat cycles and synchronization of heats in dairy goat herds and sheep flocks, shows that results are much better and of greater economic worth if synchronization is attempted during the normal breeding season.

Use of Lights to Control Breeding - Many dairy goat breeders have successfully created artificial regression of daytime light for their herds. At the end of the breeding season, the herd (males and females) are exposed to 14 hours of lighting in the barn. After at least three weeks of 14 hour days, the lighted period is reduced over a two week period, (some reduce it abruptly) to a nine hour daylight length. The barn is kept darkened for 15 hours out of every 24.

Animals begin to cycle as early as 10 days after the barn days are shortened. Regulation of light, to date, seems to be more practical and successful than hormonal regulation. However, dairy goats (particularly the Swiss breeds) perform much better during the normal breeding season.

The most successful results from hormonal or light regulation show about 50% conception rate during the artificial period and 80% to 95% conception rate during the normal breeding season.

Puberty - Doe kids reach puberty and show heat as early as four months of age if they are healthy and growing rapidly. Heats occur at 18 to 23 day intervals and does stay in heat for 8 to 24 hours.

Dairy goat buck kids are fertile about as soon as they are able to thrust their penis through the sheath and penetrate the vagina. I have seen 25 kids born in a three week period. The sire of those kids was five months old when the last of them were conceived.

Age to Breed Virgin Animals - Doelings may be bred by the time they are 7 to 9 months old if they are well grown and healthy. An arbitrary weight of 70 lbs. is commonly used by some breeders, but I have seen 80 to 90 pound doelings at eight months of age.

Scours, coccidiosis and internal parasites severely affect growth and condition of young kids. If you want to breed doelings to freshen at 12 to 15 months of age, it is imperative that they are well grown, in good flesh, and healthy by the time they should normally be bred.

Unfortunately, delaying breeding of doelings presents serious infertility problems similar to those dairy cow farmers experience when they hold back heifers from breeding at the right time (14-17 months), so they will "be larger" or "produce more milk" when they freshen at 36 months of age. It becomes increasingly more difficult for healthy dairy goat doelings to conceive if breeding is delayed after they are one year of age. Lifetime milk production of does which freshen at 12 to 14 months of age is significantly better than it is for those which freshen at 18-24 months of age.

Making the Best Use of the Breeding Season - Many breeders are successfully maintaining year round milk production by breeding their animals early or late in the normal breeding season. An attempt at controlling conception by any means demands careful watching of doelings and does for signs of heat and observing bucks carefully to make sure they show their normal intense sexual activity.

Preparation for Breeding - Optimum conception rate and optimum number of kids born can be achieved simply and economically in dairy goat herds (and sheep flocks) by making certain that the animals are in healthy, vigorous condition and gaining weight for 2 to 4 weeks before they are bred. This applies to males and females alike and fat or thin animals alike.

All animals to be bred should be given one dose of a safe effective broad spectrum anthelmintic 3 to 4 weeks before they are bred. During the one month period before breeding begins, feed the best quality forage available and increase the amount of grain mix fed. Never, under any circumstances, attempt to make females or males lose weight in advance of breeding. Loss of weight before, or for several weeks following breeding, results in fewer kids. Doelings handled incorrectly arrive at kidding with single large kids and dystocias.

Dairy goat herds should average at least a 200% crop of new born kids. If the animals bred are fat (or over conditioned), they can be let down to desirable condition if feeding is adjusted to do that at least eight weeks following breeding. Attempts to lower the weight of fat animals by withholding feed in the first six weeks after conception may result in fetal resorption. The whole point of eliminating internal parasites and improving the level of nutrition is to improve the number and viability of fetuses conceived. I have seen tragic results of mismanagement of goat herds and sheep flocks in this respect. When young does reach parturition for the first time with single excessively large fetuses, dystocia is a common sequel. Sometimes single large kids weigh as much as 10 to 12 lbs.

It may be redundant to repeat what I have already written above, but it is that important: Be sure that females are in good flesh and healthy by the time they are bred. Avoid making them lose weight for at least one month following breeding. Both of these precautions have a tremendous effect on the success of the female herd at kidding time.

After females are bred 6 weeks, you can cut back on their feed if they are too fat and the goats will be better for it. Don't ever let them lose weight, regardless of their condition, for four weeks previous to or 4 weeks following breeding.

Heat Periods - The female goat is remarkably like the mare in requiring the presence of a male to come into normal heat. Ideally, the buck to be used for breeding a small herd should be allowed through the fence communication with does to be bred.

It is often quite difficult for the owner of female goats to detect when they are in heat if a vigorous buck has not at least been within sight or sound of the does. Feral goats exhibit characteristic breeding behavior. The dominant males surround themselves with small harems and spend most of their time fighting off would-be contenders to breed the does.

Normal sexual activity for bucks in the breeding season is intense. Subordinate males may even be killed by older dominant males if they make advances to their group of does. In order to prevent males from serious injury, it is better to let them all be able to see, but not have close contact with the females which will be bred.

The buck odor has very important effect on female behavior. Various methods can be used to stimulate heats in the absence of the male - (buck jar), (presence of burlap bag which has been rubbed onto a buck's head). These are useful and almost necessary if artificial insemination is to be used.

Vasectomized bucks might also be useful. They will make it much easier to tell which does are in heat, but they certainly contribute to what can be pandemonium if other bucks are nearby.

With natural breeding, it is best to allow the buck to serve a doe when she is in standing heat and will readily allow him to do so. Most breeders allow the buck to breed the doe at that time and again as late as she will still allow him to mount.

Using artificial insemination, it is best to inseminate the doe close to the end of standing heat or within six or eight hours thereafter. AI in dairy goats is not at all difficult. Success depends upon use of good quality viable semen, passage of the insemination catheter into the cervical canal and proper handling of the semen during the entire procedure.

To sum up what I have tried to say in the foregoing discussion: Breed doelings which are large enough and healthy early enough so that they will freshen before they are 15 months old. Prepare bucks and does for breeding by proper nutrition.

Pregnancy Diagnosis - Use of the technique used by Dr. Hulet to diagnose pregnancy in ewes bred 70 to 110 days is easily accomplished in does. New electronic devices for pregnancy detection are useful and quite effective after six weeks from breeding date. However, this method requires expensive equipment in well trained hands.

Ballotment - When no other methods are used, visual detection of fetal movements in the right flank area of pregnant does can usually take place after four months. Large fetuses are commonly active following ingestion of a long drink of cold water by a thirsty doe. Simple ballotment in the right flank is usually quite easy and dependable after 120 days of pregnancy.

Reproduction management of a dairy goat herd lies somewhere between the procedures used for a milking cow herd and a flock of sheep. The seasonal nature of breeding, the presence of a buck or his odor, and the importance of nutrition (good condition and prevention of anemia) all require careful attention if the dairy goat owner wants to achieve a relatively stable level of milk production and a large annual crop of healthy kids.

MINNESOTA DAIRY GOAT INDUSTRY AND RELATED LAWS AND REGULATIONS

Harold Johnson
Dairy Supervisor
Minnesota Department of Agriculture
Dairy Industries Division

Frequent telephone calls and letters of inquiry are received in our office from owners or prospective owners of dairy goat herds, and also from customers who wish to locate a source of goat milk or milk products. The inquiries from dairymen most often relate to the marketing of products in the raw or unpasteurized state, or to the requirements for processing milk for sale as pasteurized products.

The consumer inquiries, usually regarding available goat milk, are replied to by informing the individual that pasteurized Grade A goat milk is available from outlets supplied by one Minnesota producer. The names of goat milk dairies where milk may be purchased as raw milk are also supplied from a list in our files.

This list is in need of updating. The names of dairymen wishing to sell to consumers will be included on the list if you send your name, address and telephone number to my attention.

RESTRICTIONS ON SALE OF RAW MILK

As Minnesota law prohibits the sale of raw milk to consumers, except on the farm where the milk is produced, the delivery of raw milk is not permitted. Advertising the sale of raw milk to consumers is also not allowed. As this restricts to a large degree, the sale of raw milk, the alternative is to process or have milk processed in licensed, approved dairy plants.

DAIRY PROCESSING PLANT REQUIREMENTS

The state requirements for licensed dairy processing plants include suitable buildings, water supply, sewage disposal, approved processing methods, adequate equipment, lighting and ventilation, and approved floor plans prior to construction of a new building or alterations to an existing building. We will provide advice and assistance in planning or remodeling facilities and in selecting processing equipment.

MILK PROCESSING ALTERNATIVES

Because of the limited volume involved, providing of approved milk processing facilities will seldom be within reach of the individual producer. Perhaps the most practical solution is to have the milk processed in an existing plant, or to form a cooperative or corporate unit where the milk of members or suppliers may be combined.

SALE OF GOAT MILK TO PROCESSORS

As the products made from manufacturing grade milk, including butter, dry milk products and most of the cheeses, are defined by regulations as containing only cows milk, it is not legal to combine milk other than cows milk into

the products. This in turn eliminates most of the processing plants as markets available to goat milk producers.

The manufacture of cheese in which goats milk is a listed ingredient with cows milk, or the use of all goats milk in cheese manufacture of specified varieties is a possible market available to the goat milk industry.

GRADE A REGULATIONS FOR GOATS MILK

The same specifications and requirements apply to both goats milk and cows milk to achieve Grade A certification. One difference in enforcement procedure relates to the animal health item which requires that dairy animals be located in areas accredited free from brucellosis and tuberculosis. As accredited areas for goats are not provided, each herd must be individually tested and accredited.

The State Department of Agriculture recognizes the potential of the dairy goat industry to contribute toward the economy of the state and more specifically to Minnesota agriculture. We will assist in formulation of plans which will improve your marketing position.

THE BEST MATING FOR MY DOE:
SELECTING THE BEST BUCK FOR MAXIMUM IMPROVEMENT

David D. Kowalski
MEGA Director
Author of THE SECRETS OF THE GREAT ANIMAL BREEDERS

Thomas Fuller, a 17th century Englishman, enlightened the world when he observed that, "The best oil is on the top, the best wine in the middle, and the best honey is on the bottom." If Fuller had been a goat owner, I am sure he would have added - "and the best goats are not always in the other fellow's herd."

That may or may not be your situation at present but the option to improve your stock is readily available. When I speak of improvement, I am talking about the greatest possible improvement that can be made in each generation of your breeding program.

Each of us begins with animals of different quality - whether because of personal finances or good fortune, or both. Let me begin by assuring you that the goats you have at the present are the best that there are. However, they may not be the best that can be bred. Striving to make them the best that can be bred can be a great motivating force in your dairy goat hobby or business. When all is said and done, the degree of improvement that you make in your stock from year to year might very well be your greatest source of satisfaction.

Whether your interest in dairy goats is simply to have a few milkers to provide table milk, or many animals to provide the product demands of your commercial market, or to engage in the competitive and social activity of showing - the fact is that those does must be bred and produce offspring to make them useful for your purpose.

Every doe that you own provides you with the opportunity to make your stock either better or worse, more efficient or more inefficient, for your particular purpose. It is certainly not likely that your animals will get better without some effort on your part. And, it must be said, the kids you breed don't always exhibit the features or the degree of the feature that you had hoped for. Sometimes the luck of the draw doesn't work in your favor. In the long run, however, the breeder who makes the most informed mate selections most persistently will be rewarded for his efforts.

The best breeders are the ones who make the greatest effort to stack the deck in their favor. Then the higher card, the kid that is better than either parent, is more likely to be produced.

Animal breeding is very much a game of chance. Every doe is born with all the eggs she will ever have. Each of them contains a "sample half" of the genetic information that is necessary to create the new individual. At each ovulation, one or more of those eggs matures and is released in anticipation of being fertilized. If a buck is present and decides to cooperate (they rarely refuse), fertilization occurs. Each of the twenty million or so sperm that he releases for the "foot race" to the egg are different in some way. They, too, contain a random sample half of all the genes that the buck is capable of producing. The winner of that great race to the egg, which only one sperm cell can win, is the

real sire of the kid produced. If some other sperm cell had "won the race", that kid could have been vastly different.

This is where you enter the picture. You determine which buck will be allowed to mate with each doe that you own. If you have been having some problems in this regard then you will just have to build your fences higher or stronger.

I realize that some of you might think that none of this is worth the effort. Goat owners, especially, seem to be afflicted with the misconception that one buck is the best mate for every doe they own. In most cases, he is usually the first buck they happened to buy. The fact that he is close at hand may make him the convenient choice for this breeding season but he may not be the most economical choice. In the long run, his convenience may prove to be very costly, indeed.

Although I occasionally offer bucks for sale, I make it a point to discourage beginning goat owners from purchasing a buck if at all possible. Unfortunately, a buck is often the very first member of the new herd. This amounts to buying the saddle before you have the horse. The chances of a proper "fit" are virtually impossible. What you want is the best "fit", the best mating that can be made in each and every case. This maximizes your potential for improvement.

If the buck you own is one of the truly great sires of the breed, then he could very well be the perfect mate for every female brought to him. If he is perfect in all the features of major importance, and all his progeny are equally endowed, he could very well be the answer to every doe's dreams. Whether you generally practice inbreeding, linebreeding, or outcrossing, to fail to take full advantage of such a great breeder would be the height of folly. However, such prepotent breeder's seem to be relatively rare, except when you are talking to an owner who is particularly anxious to collect another breeding fee.

The fact is that even the greatest of sires should not be mated to does that possess the same faults that he does or that he is inclined to reproduce. This is the essence of the law of physical compensation. Whatever the nature of your breeding program, it is not likely to be successful if this law is ignored. You can inbreed or linebreed or never mate together closely related animals, but if you ignore the faults and the qualities of the chosen mates, your stock will deteriorate just as certainly as it could have been improved.

Simply mating together two animals because they happened to be members of the same breed or the same family within the breed can hardly be dignified by calling it a breeding "program". A program implies concrete plans and clear priorities. A plan implies that you know where you are going with your dairy goat enterprise.

What are your goals with your dairy goats? Only you can answer that question. Do you want vigorous, efficient, disease-free homestead milkers? Do you want equally efficient milkers in a large commercial herd? Must your animals also be competitive in the show ring, or score in the higher ranges of a classification program? Whatever your goal, you should make every effort to find and use the bucks that are likely to help you the most.

While it is true that for any particular kid, both the sire and the dam provide 50% of its genetic make-up, the broader view gives a different perspective on the importance of the sire.

In a study of 2,000 dairy cows produced by artificial insemination, Professors Rendel and Robertson calculated the percentage of genetic improvement that can be expected from the following sources:

| | Percent of Improvement |
|-----------------------------------|------------------------|
| Dams of future herd replacements | 6 |
| Dams of future young sires | 33 |
| Sires of future herd replacements | 18 |
| Sires of future young sires | 43 |

Rendel, J.M., and Robertson, A., Jour. Genet., 50:1-8, 1950

Although these calculations were made with dairy cattle nearly 30 years ago, there is no reason to suppose that they would be significantly different today or that they would not apply to dairy goats.

This analysis shows that the greatest opportunities for genetic improvement come from the choice of the sires and dams of our future herd sires. Actually, choices of sires control the last three items, making up over 90% of the opportunity for improvement by selection.

The soundest advice for anyone's breeding program is to use well-proved sires for the traits in question for the most rapid gains. However, in comparison with the dairy cattle industry, the dairy goat industry is not very far along in identifying bucks proven for their ability to improve amounts of milk, butterfat, and certain features of conformation in daughters compared to their dams. This leaves most of us in the position of having to use relatively untested sires. In fact, every proven buck is at one time an unproven buckling.

This state of affairs makes it all the more important to thoroughly understand and appreciate Rendel's and Robertson's analysis. If bucks ultimately account for 90% of the expected improvement in one's herd, then the choice of a mate for our doe should not be taken lightly. Poor selection, or even no selection at all, can just as surely leave us with poorer animals than we started with.

My observations lead me to believe that many goat owners find themselves in this predicament, get disgusted, and quit dairy goats. I call this the "flash and crash" syndrome. There is a good deal of initial enthusiasm, a rapid expansion of the herd with neither a sound plan nor a goal, haphazard breeding methods and selection based on a lack of knowledge, and finally a decision to call the whole thing off. The financial losses, the wasted breeding stock, and the wasted energy are significant. Even the dispersal sale doesn't recover much if the animals need two or three generations of good breeding practices to get them back up to a mediocre level. Who wants to buy somebody else's mistakes?

I am not unaware that the Bible teaches that "pride goeth before the fall". Nevertheless, I am equally aware of the motivating force that a real, sustained, and sensible pride in one's animals can be. We may not start out with the best of stock but that is no excuse for not arranging our matings to make them better.

Pride is the only viable alternative to the "flash and crash" syndrome - pride in the animals that one works with every day of the year, and enough pride to

want better, more efficient, more profitable dairy goats to work with tomorrow, next year, or ten years from now.

Working for that improvement through better mate selections makes sense, and it also generates increased dollars and cents for you. Paying someone a slightly higher stud fee in order to use a buck that is the best of the available choices for a particular doe may cost you a bit more, initially, than using one that is cheaper or closer. However, if the youngsters produced from that mating stand higher up in the show line or produce more milk and butterfat through more lactations, then that stud fee will seem inconsequential. If you are careful in your choice of sires, you will not be spending money for breeding fees unless that buck promises to deliver the expected improvement that you are paying for.

The place to begin this process is with your does. Analyze their strengths and weaknesses in important areas of conformation and in production. If you are unsure of your ability to do this at first, ask for an evaluation from a knowledgeable fellow breeder or judge or trained classifier. Put your does on official test or keep your own accurate milk records.

Once you have analyzed each of your does, then do the same for the bucks you own or could possibly use for a breeding fee. Evaluate any offspring that a buck might have sired for evidence of the traits you want to acquire. If the buck has no progeny, then you will have to make some educated guesses about his likely potential. Was his sire a well proven buck? If he was, then there will be a number of paternal half-sisters to examine. How about his dam? Is she the kind of doe you would like to breed consistently? What were her other offspring like? Learn as much as you can about the sires potentially available to you.

Sure, all this takes time. But so does taking care of animals that may not be as vigorous, disease-free, and productive as they could be. If you can spend less time coddling poor animals, you will have more time to devote to the animals that will more than repay your extra efforts.

To make the best mating for your doe, you should breed her to the buck that is most likely to reinforce her strong points and, at the same time, does not possess any major faults that she might have. Such a policy will generally result in a steady improvement of the features that you select for. Eventually, faults that your animals might have had in your first years in the breed should be more or less rapidly eliminated.

Keep breeding toward your ideal with every mating that is planned. May all your kids be winners - either for you or for the satisfied customers who bought them from you.

SELECTION OF DAIRY GOATS

Douglas Thompson
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Milk records, health records, dealer reliability, and bloodlines should never be ignored in selecting a dairy doe, however, your evaluation of a doe's conformation can be an important key to her value to you as a milker.

SEEKING THE IDEAL

To begin where I left off in a similar discussion last year, always keep in mind a vision of the ideal dairy doe. This is a doe that has strength, depth, width, sharpness, and a large, well-shaped, well-attached udder. She is built strong to hold up over the stress of annual kidding and heavy milking over several years. She moves about easily and powerfully on strong legs and feet. She has great depth and width to allow her to consume large amounts of feed, water, and air and provide room for 2 or 3 kids. At the same time she is sleek and sharp-featured because she is putting all that feed into milk and not fat. She has a large udder to hold plenty of milk and it is tucked firmly up under the body, out of harms way. It has two well-sized, well-shaped teats for easy milking and the udder texture is soft and spongy as an indication of excellent milking ability and health. This is what we are looking for in a dairy goat of any breed.

DAIRY DOE SCORECARD AND CLASSIFICATION

The American Dairy Goat Association (ADGA), over several years of deliberation and consultation, has developed a score card for evaluating a dairy doe. It is divided into 4 categories dealing with general appearance, body capacity, dairy character, and mammary system. Each category is assigned a particular number of points. An overall total of 100 points is possible, yet has never been attained.

This score card can be your number one best friend and counselor when buying stock, if it is properly studied and used. In the last 3 years, ADGA has laid its reputation on the line and placed its faith in this score card by beginning its far-sighted classification program. This allows the absolute scoring of a doe's characteristics by a highly trained classifier. Classification provides a description of each major part of the doe that is being classified and assigns a score to each of the 4 areas of body conformation, as well as a weighted average of those four scores. It would be naive to say the system is perfect, but in general, a doe classified 85 in New Jersey would be equivalent to one classified 85 in New Mexico.

General Appearance

This category rates 30 points. It is basically an evaluation of the frame upon which are built the working parts. It includes features such as breed characteristics and style - 10 points; back, loin, rump, and tail - 8 points; and the legs and feet - 12 points. There are some extremely musical though illusive terms included in this category, such as "attractive individuality revealing vigor," and "impressive style and attractive carriage," and "bright eyes and alertly carried ears." Most of these terms describe what I would call "confidence" and good health. Though this is difficult to objectively describe, it is the basis of the pecking order and I have no doubt that it pays off at the feed bunk as well as on the score card.

The 8 points allotted to the topline have considerable bearing on the longevity of a doe and, to some extent, on the ease of kidding—an important step to a good lactation. By the same measure, the legs and feet are given a great deal of emphasis on the score card and rightly so. There are very few breeds of domestic livestock that don't need strong legs and feet, whether you are talking about goats, horses, or chickens. Management and environment can have a large effect on the score in this respect.

Body Capacity

This category rates 20 points on the score card, 12 for the barrel and 8 for the heart girth. It relates to having enough room for the fuel and the furnace, or a great capacity for large quantities of roughage. This is essential to a sound feeding program and an economic dairy operation. The deep-bodied, well-sprung doe has the advantage here, but there is somewhat less correlation between these characteristics and actual production. Some slab-sided, shallower-bodied does can be tremendous producers, however, often these does are quite long-bodied and they gain their barrel capacity in this way. Again, the management of young stock can affect the barrel capacity of the adult since excessive milk feeding will not allow the kid to develop the large, strong rumen it will need as an adult.

A large capacity for a strong heart and lungs within the heart girth is also important and is recognized on the score card. Does that are narrow in the chest are often narrow all the way through and various leg problems, such as out-turned forelegs and hocked rear legs can be associated with this condition.

Mammary System

This is the most easily understood category of the score card, allowing 30 points. Ten (10) points are allotted to shape and capacity, 4 points to teats, 6 points to fore-udder, 5 points to rear udder, and 5 points to texture. Obviously, a large, well-constructed mammary system is necessary for a lot of milk, easily acquired, over a long period of time. There are numerous examples of rather poor udders that provide plenty of milk and milk production is the bottom line. However, consider also that frequent udder injury, slow milking, hard-to-handle teats, swinging and bruised udders, and dirty udders are all factors that are too often neglected in evaluating a doe. These things all require extra effort in management and that translates into money or hassle. As the saying goes, the strongest doesn't always win, but that's the way to bet.

Dairy Character

If the mammary system score is the easiest to understand then the dairy character score is the most difficult. It has been defined as "the will to milk with the ability to sustain it," another flowery but quite useful definition. The score card show 20 points for this category but just how much of that to allot to a particular doe is difficult to estimate. Dairy character is recognizable in sharpness at the withers, freedom from excess tissue, flatness and flintiness of bone, width between the ribs, pliable and loose skin, leaness in the thigh, and openness in the muscling and ribbing. It is closely related to type - contrasting meat animals and dairy animals.

The most difficult aspect of this category is that it relates so closely to every other category on the score card. For example, the question often arises, "How can a doe be penalized for lack of dairy character if she has a large quantity of milk, even though she has a poorly shaped or attached udder?" The answer to that question lies in the definition of dairy character and another question, "Can this doe 'sustain' her production over a long period?" Most experts hedge with a qualified no, keeping in mind that there are several good old does that would make them look a bit silly if they we more definite. Perhaps the long-term answer is found in those does that have both high production and well-attached udders. If we can have both characteristics, why settle for only one?

BECOMING PROFICIENT WITH THE SCORE CARD

The value of a dairy doe can be measured by the dairy score card and it can be done by nearly anyone with a desire to learn and ask questions. It takes some practice so rate your does, go to shows, attend a classification session, attend a pre-training conference, listen closely and above all, ask questions.

MANAGING YOUR FIRST GOAT
PITFALLS THAT LEAD TO POOR HEALTH

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In the beginning of this presentation, it must be stated emphatically, that it is very difficult to start keeping dairy goats with a single animal as the nucleus for your dairy goat enterprise. Following is a list of criteria which should be considered by everyone beginning goat keeping.

The Number of Animals to Start With - It is absolutely necessary that the beginner start with not less than two animals. It is better to purchase at least two does of the same breed, age and size. Two mature does 3 to 5 years old would be excellent starter animals if they are about the same age/size/condition. Dairy goat females are gentle enough with people, but they can be merciless abusers of other goats. Older does are easier to handle, to manage and to milk than are doelings. New goats are best purchased when they are dry and have at least 30 days to go before they will kid.

Veterinary Examination - It is very important that one should start with dairy goats free of contagious or infectious disease. It is better to pay a veterinarian to take a blood sample for brucellosis test and conduct an interdermal tuberculin test than it is to discover that you have animals which are a menace to those who handle them or drink their milk.

It is true that brucellosis and tuberculosis are extremely rare diseases in American dairy goats, but it is pure folly to risk the possibility that a new animal might be infected.

Demand Health Certificates - Ask the seller of your animals to furnish a certificate signed by a licensed accredited veterinarian. This document should state that the veterinarian has examined the animals and the herd from which they originated and found them to be free of symptoms of infections and contagious disease.

The certificate should be signed by the veterinarian and dated the day the animals were examined. Many veterinarians list some of the common infections and contagious diseases. A typical list would include: contagious caseous lymphadenitis, ring worm (mycotic dermatitis), sore mouth (contagious ecthyma, foot rot, pink eye, pulmonary disease, evidence of external parasites, physical defects, mouth defects, teat and udder defects, genital defects, or unsoundness of any type).

If you buy animals and the certificate of health poses any problems for your clear understanding, have a veterinarian of your choice carefully examine the animals for evidence of the diseases listed and withhold payment for the animals until he has examined the animals and the tests for brucellosis, tuberculosis and Johnes' disease have been satisfactorily completed.

Pregnancy Information - Purchase of dry pregnant animals is most likely to occur during late fall or winter months. Be sure that you receive all breeding information. Know what dates animals were bred and what dates they were rebred. Pregnancy examination will furnish necessary assurance that the animals are indeed pregnant.

Use of a rectal probe is a very simple procedure in which pregnancy can be diagnosed with a high degree of accuracy from 70 to 110 days. Animals bred over 120 days can usually be easily diagnosed pregnant or not pregnant by simple ballotment.

Feeding your New Goats - Feeding is by far the most important management consideration for maintaining health and efficient milk production of dairy goats. The new animals, if pregnant and not milking, will require a maintenance ration of good quality mixed grass-legume hay and a balanced dairy cow grain ration containing at least 14% protein, relatively high level of energy (at least 75% TDN, minerals and vitamins).

Special feeds for goats are not necessary. In fact, most of those feeds are not adequate for dairy goats and they are not economical to use. If you have any doubt about what kind of grain mix to feed to dairy goats, ask your county agricultural extension agent to recommend a dairy farm for you to visit to learn about what he feeds his cows. He can be a very valuable help to you, recommending the kinds of hay which can be fed for best results to dairy cows in your area and the kinds of balanced dairy cow grain rations which should complement that hay.

The amount of grain fed to new animals at that stage of pregnancy and lactation will vary somewhat, but an ordinary maintenance level for a pregnant, dry doe should be about 1/2 to 1% of her body weight daily, with ad lib feeding of good hay.

Management of does during the last six weeks of pregnancy has a great bearing on health of the doe and her kids and the level of milk production after kidding occurs.

Does in Late Pregnancy - Under no circumstances should does be allowed to lose flesh in late pregnancy regardless of the amount of flesh they carry at the beginning of that period. The amount of grain fed should be gradually increased from the maintenance level fed during the dry period to at least 1 to 2% of body weight by the kidding date.

There should be no restriction of amounts of forage fed. Good quality mixed grass-legume hay is much to be preferred over high quality alfalfa hay during this period. Feeding alfalfa hay provides excessive calcium beyond the animals' needs at this time and predisposes the animal to milk fever.

Management and Care at Kidding - Normal kidding in the dairy goat is a relatively rapid process. The three stages of parturition are much more rapid than in the cow or sheep. Preparation for active labor usually requires less than one hour. The animal may show excessive friendliness, move off by herself, paw at her bedding or look around at her sides.

After fluid is expelled or any evidence of placenta or kid is shown, active expulsion of the kids should take place within a half hour. If anything interferes with the immediate birth of the kids at this stage, the doe should be examined and aided as necessary. Do not wait or delay at this point. Delays at this stage usually result in closure of the cervix followed by disaster.

Until you have had experience with several does in normal deliver, make sure that the doe has attention if there is any doubt that things are not going well. Certainly, one who has does kidding for the first time should seek assistance from a veterinarian or a neighbor goat-keeper. What I am trying hard to say is: Don't wait as the dairy man does with his cows unless you are sure that everything is progressing normally.

(Slides of normal and abnormal presentations)

If there is any doubt that birth is not proceeding naturally, the doe should be examined. Anything other than a simple normal forward presentation with the front feet forward and the kid's muzzle between the fore legs requires help (at least for the beginner). A near-by goat breeder can be of great assistance and assurance if you have any doubts at this time.

Allow the doe to clean off her kids after they arrive. It will help to rub them dry with a piece of toweling. Dip the navel cords into a baby food jar or mustard jar of 2% tincture of iodine.

The pacentas should be expelled within 24 hours. If not, a veterinarian should remove it. Fortunately, retained placenta is relatively rare in dairy goats.

Feeding the New Mothers - Feeding new mothers requires special care. Immediately after kidding, they should be given all of the tepid water they will want to drink and about the same amount of grain which had been fed at a feeding before kidding.

A coarse dairy feed based on the quality of forage available should be fed. (See your neighbor cow dairyman, your veterinarian, county extension agent or a dairy goat publication about this.)

A normal doe should have a good appetite for grain and eagerly eat hay within an hour of kidding. Start regular feeding with the amount fed just before kidding and increase grain feeding each day as the doe increases in milk production. By the end of 10 days, you should have her eating a pound of grain for every three pounds of milk she produces. Many people feed a pound of grain for every two pounds of milk. This is all right as long as the doe increases her milk output. However, if the doe does not continue to improve production as you increase the feed, that is the time to back off and decrease the amount of grain per pound of milk produced.

The idea of feeding does all the grain they will eat after they have kidded at least ten days, is not a bad one. Free-choice grain feeding challenges the good does and will enable you to determine whether or not to cull the poor ones.

Feeding Baby Kids - As soon as the kids get to their feet and show signs of wanting to nurse, milk about two ounces of colostrum (first milk) from the doe for each kid, after washing off her udder thoroughly and drying it. Feed the colostrum to the kids, if possible, before they are 30 minutes old. It can be fed from a clean nursing bottle or from a clean metal pan. Baby kids should be fed at least three times daily for the first five days, then twice daily thereafter.

Increase the amount of milk to 10 ounces per feeding by the time they are two weeks old. Baby kids can be fed a pint of milk twice daily by the time they are four weeks old. Baby kids should have access to dairy feed and the hay they like best. (That is not always the very best looking hay available.)

Culled Baby Kids - If baby kids are culled for any reason, they should be fed all the good hay, dairy feed and milk they will take until they are six to seven weeks of age. Then they can be slaughtered or sold for slaughter.

HOMESTEADERS: PRODUCT POSSIBILITIES

by

Thomas E. Hicks

Most of us who get involved with dairy goats do it for one of several basic reasons: for fun, for the milk, or to make a living. The commercial aspect of making a living seemed to be out of financial reach for me, so I ended up raising goats for the fun and the milk.

Whenever I've had goats I've always had a steady supply of milk. That's not too difficult if you keep at least two animals. The problem, it always seems, is in the definition of the word fun. When you need milk for breakfast and she steps on the edge of the bucket, no fun. When your Nubian buck gets out in the middle of November and goes to visit the neighbor's prize-winning Alpines, no fun. When all the does forget their milking order and decide it's their turn to be first, no fun. Why then raise goats? For me the list is endless.

First and foremost is the milk. A constant ever-ready ever-fresh supply. It doesn't take long, however, before you realize that with a gallon per day from each doe a constant supply soon becomes an over-supply. It's at this point that most of us get fleeting thoughts of selling all that excess; of building up a group of customers who come every Thursday, Sunday and Tuesday to buy that extra. Unfortunately it's never quite that consistent--for you, your customers or the goats. There are, however, ways that you can use all that white gold. Depending upon your own situation, some may be more practical for you than others. My listing here is not necessarily my recommended priority, but does represent ways that I have used to use up the excess milk short of drying up the source.

- Milk
- Cream
- Butter
- Skimmed Milk
- Ice Cream
- Yogurt
- Cottage Cheese
- Soft Cheese
- Hard Cheese
- Soap
- To Raise: Goat Kids
- Pigs
- Chickens
- Vealer Calves

With a lot of digging, research, and lots of questions in the right direction, it's possible to find information on all of these suggested milk uses. Start with the accompanying bibliography if you're new at this. In the interest of time and space I will cover only a few here and then only in sparse detail.

Making Cream

One of the most beneficial aspects of goat's milk is the small fat globules that are so tiny they are very easily digested. Unfortunately, this wonderful fact is a bummer fact when it comes to making cream. Goat milk fat particles are so small that they remain suspended in the milk, do not cling together and consequently do not rise to the top. What this all means is that you must use a cream separator if you expect to get any appreciable amount of cream from your goat's milk.

Making cream is not really an art, but you will need to have some facts down before you begin.

1. Cleanliness! Considering how many steps the milk is going through, it is imperative in all milk handling that you and all your utensils be CLEAN!
2. The closer the milk is to actual body temperature of the animal, the better separation you will get. 100° F (38° C) is about right.
3. Make sure you know your separator and have it oiled and in good working order.
4. Make sure you turn the crank at the proper speed.
5. If it's your first experience at separating, make sure you have a friend or two to help relieve you with turning the crank (and at least one extra chair).

Please refer to the bibliography for details on separating milk.

- #1 pg. 21
- #2 pg. 314, 328
- #3 pg. 136
- #8 pg. all

Making Butter

Butter making requires a little more technique than separating and may also take a few batches before you get good at it. If it doesn't work for you the first time be sure to try it again--the thrill, taste, and nutrition of it are worth it!

Remember:

1. Cleanliness!
2. Temperature of cream when churning: 52° - 60° F (11° - 15° C) in summer and 60° - 65° F (15° - 19° C) in winter.
3. Choose the method best for you:
 - a. a simple jar (great for groups)
 - b. a butter churn (very nostalgic)
 - c. a hand or electric mixer (o.k. but noisy and messy)
 - d. a blender (fast, but small batches)
4. Wash all the buttermilk out.

Please refer to the bibliography for details on making butter.

- #1 pg. 21
- #2 pg. 329-331
- #3 pg. 136-138
- #4 pg. 3
- #8 pg. 17

Making Yogurt

Now is when you start learning to be an artist. Making yogurt is really quite easy, but it may take you many times before it becomes second nature. Don't let the long directions and recipes scare you off. After you get good at it and can make a quart in 15-20 minutes, you'll wonder what all the words were about.

- Remember:
- 1. Cleanliness.
 - 2. Not all recipes say to pasteurize, but it's best (not necessary).
 - 3. If you use a commercial starter, follow their directions exactly.
 - 4. There are at least four methods to use:
 - a. a commercial yogurt maker (another expense)
 - b. oven method (large quantities)
 - c. thermos method (very convenient)
 - d. heating pad (very convenient)

Refer to the bibliography for details on making yogurt.

- #2 pg. 317-318
- #3 pg. 130-132
- #4 pg. 4-6

Making Cottage Cheese

By this time there is no doubt that you are ready for the final exam in this art class. Making cottage cheese is by no means difficult, but it does require a person to be extremely careful and exact with amounts, times and temperatures. Read all the literature first, then decide which recipe or method is best for you. Cottage cheese to some people is farmer's cheese to others. So be sure you know that what you are making is what you want.

- Remember:
- 1. Cleanliness
 - 2. Can be made with skim or whole milk.
 - 3. There are recipes to make it in a half hour and some take five days. Try several and taste. (Tasting's what's important).

Please refer to the bibliography for more details on how to make cottage cheese.

- #1 pg. 21
- #2 pg. 319-320
- #3 pg. 138-144
- #5 pg. 79
- #7 pg. 14

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D. Dairy Goat Feeding

1. Feeding Dairy Goats - Current Inf. Series No. 296
E. A. Fiez, Department of Animal Sciences, University of Idaho, Moscow, Idaho 83843 (1975) -- 2 pages.
2. "Dairy Goats Do Well on Free-Choice Feeding"
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3. "Forage Utilization and Nutrient Requirements of the Goat"
J. E. Huston, Texas Agricultural Experiment Station, Texas A & M University, Agricultural Research and Extension Center, San Angelo, Texas 76901, Journal of Dairy Science, Vol. 61, No. 7, (1978) -- 988-993 pages.
4. Feeding the Dairy Goat, Special Circular 233
D. L. Ace Dairy Animal Sciences Department, Pennsylvania State University, University Park, Pennsylvania 16802 -- 2 pages.

E. Dairy Goat Housing and Equipment

1. Barns and Buildings for Dairy Goats
A. L. Klingbeil, Tiger Press, Columbia, Missouri 65201, for American Supply House, P. O. Box 1114, Columbia, Missouri 65201 -- 47 pages.
2. Housing Equipment and Care of Dairy Goats, D-235
D. V. Armstrong, Department of Animal Sciences, University of Arizona, Tucson, Arizona 85721 -- 4 pages.
3. Housing and Equipment for Dairy Goats, Guide 400 D-703
Borden Ells, Department of Animal Science and Range Sciences, New Mexico State University, Las Cruces, New Mexico 88003, (1977) -- 2 pages.
4. Dairy Goat Housing and Care
D. A. Anderson, Animal Science Department, Oregon State University, Corvallis, Oregon 97331 (revised April 1976) -- 4 pages.

5. Housing for Dairy Goats, Special Circular 236
D. L. Ace, Dairy and Animal Sciences Department, Pennsylvania State University, University Park, Pennsylvania 16802, (1978)
-- 2 pages.

F. 4-H Publications

1. Dairy Kids and Goats, 4-H Publication B-12
4-H Office, 475 Coffey Hall, University of Minnesota, St. Paul, MN 55108 -- 37 pages.
2. Indiana 4-H Dairy Goat Club Record (4-H 589) -- 16 pages.
Jack L. Albright and co-workers, Cooperative Extension Service, Purdue University, West Lafayette, Indiana.
3. The Dairy Goat -- 4-H Member's Guide
C. W. Richardson, Department of Animal Sciences and Industry; Sue Blakely, Agricultural Information Services, Oklahoma State University, Stillwater, Oklahoma 74074 (1976) -- 24 pages.
4. 4-H Dairy Goat Work Manual, Units 1 through 7
Darrel Bolz and Ed Fiez, University of Idaho, Moscow, Idaho (1978).

G. Books

1. Making Your Own Cheese and Yogurt
Max Alth, Funk and Wagnalls, New York.
2. Raising Milk Goats the Modern Way
Jerry Belanger, Garden Way Publishing Co., Charlotte, Vermont 05445.
3. Kidding Around: Goat Cartoons
Betsy, Hall Press, P. O. Box 5275C, San Bernadino, California 92412.
4. Dairy Goat Judging Techniques
Harvey Considine and George Trimberger, Dairy Goat Journal, Box 1808 Scottsdale, Arizona 85252 (1978).
5. Goat Production in the Tropics
C. Devendra and Marca Burns, Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England (1970) -- 184 pages.
6. Good Beginnings with Dairy Goats
Josephine Emily Eberhardt, Dairy Goat Journal, Box 1908, Scottsdale, Arizona 85252 (1975) -- 192 pages.
7. Observations on the Dairy Goat, FAO 1970
Unipub. Inc., 650 1st Avenue, Box 433, Murray Hill Station, New York, New York 10016.
8. Feed and Nutrition, Chapter 22, "Feeding Goats"
Dr. M. E. Ensmiger and Dr. C. G. Oletine, The Ensmiger Publishing Company, 3699 East Sierra Avenue, Clovis, California 93612 (1978)
-- pages 787-813.

9. Management and Diseases of Dairy Goats
Dr. Samuel B. Guss, V. D. M., Dairy Goat Journal Publishing Corporation, Scottsdale, Arizona 85252 (1977) -- 222 pages.
10. Dairy Goats: Selecting, Fitting and Showing
Alice Hall, Hall Press, P. O. Box 5375, San Bernadino, California 92412 (1975) -- 87 pages.
11. Goats
H. E. Jeffrey, Diamond Farm Book Publishers, Dept. DG, Box 266, Alexandria Bay, New York 13607.
12. The Goat Owner's Scrapbook
Dr. C. E. Leach, American Supply House, Columbia, Missouri 65201 (Second printing 1971) -- 386 pages.
13. Aids to Goatkeeping
Dr. C. E. Leach, Dairy Goat Journal, P. O. Box 1908, Scottsdale, Arizona 85252 (8th Edition 1974) -- 277 pages.
14. "Nutrition and Feeding of Goats in Digestive Physiology and Nutrition of Ruminants," Vol.3, Practical Nutrition (Ivan L. Lindahl, SEA-AR, USDA, Beltsville, Maryland).
D. C. Church, Senior Author and Editor, Oregon State University Bookstores, Inc., Box 489, Corvallis, Oregon 97330.
15. Goat Husbandry
Davis MacKenzie, 5th Edition, 1975, Diamond Farm Book Publishers, Dept. DG, Box 266, Alexandria Bay, New York 13607.
16. The Book of the Goat
H. S. Holmes Pegler, "The Bazaar Exchange and Mart," LTD Link House, 24 Store Street, London WC-1,England, published by American Supply House, P. O. Box 304, Columbia, Missouri 65202 (1965) -- 251 pages.
17. The Modern Dairy Goat
Joan and Harry Shields, C. Arthur Pearson, LTD Tower House, Southampton Street, Strand WC-2, London, England, published by Tiger Press, Columbia, Missouri 65201, or the Dairy Goat Journal, Inc., P. O. Box 190, Scottsdale, Arizona 85252 (1949) -- 172 pages.
18. Living on a Few Acres, the 1978 Yearbook of Agriculture, USDA
"Dairy Goats Require Lots of Care Just to Break Even," Donald L. Ace, pages 357-364.
19. The Illustrated Standard of the Dairy Goat -- A Guide for Evaluating and Judging Conformation
Nancy Lee Owens, Dairy Goat Journal Publication Corporation, P. O. Box 1908, Scottsdale, Arizona 85252 (revised edition 1977) -- 131 pages.
20. Starting Right with Milk Goats
Helen Walsh, Garden Way Publishing Co., Charlotte, Vermont 05445,1972.
21. The Role of Sheep and Goats in Agricultural Development
Winrock International Livestock Research and Training Center, Morrilton, Arkansas 72110 (1976) -- 43 pages.

H. Miscellaneous Materials

1. Proceedings, 1st Annual Dairy Goat Conference.
Office of Special Programs, 405 Coffey Hall, University of Minnesota,
St. Paul, MN. 55108 -- 56 pages.
2. California Dairy Goat Publications -- 1975, 1976, 1977, and 1978
Frank D. Murrill, Animal Science Department, University of
California, Davis, California 95616.
3. Dairy Goat -- Correspondence Course 105
Correspondence courses in Agriculture and Home Economics, 307
Agricultural Administration Building, The Pennsylvania State
University, University Park, Pennsylvania 16802.
4. Dairy Goat Films
Genus Capra Films, 8780 Trinkle Road, Dexter, Michigan 48130.
("AI Techniques," "Fitting and Showing," "Breeding and Kidding,"
and "Basic Management.")

ORGANIZATIONS AND SUPPLIERS

A. Dairy Goat Associations

1. The American Goat Association
Don Wilson, Secretary Treasurer, Box 186, Spindale, North Carolina
28160.
2. The American Goat Society
H. Wayne Hamrick, Secretary, Route 2, Box 112, DeLeon, Texas 76444.
3. Dairy Goat Club Directory is published annually in the February
issue of the "Dairy Goat Journal."

B. National Dairy Goat Breed Associations

1. Alpine International Club
Jan Palmer, Secretary-Treasurer, Skamokawa, Washington 98647.
2. American Lamancha Club
Mrs. Virginia Marhefka, Secretary-Treasurer, 93 Faller Road,
Lowell, Massachusetts 01854.
3. National Nubian Club
Mrs. Linda Brake, Secretary-Treasurer, 5225 East Pershing Avenue,
Scottsdale, Arizona 85254.
4. National Saanen Club
Mrs. Minnie Waterman, Secretary-Treasurer, RFD 2, Kerr Road,
Canterbury, Connecticut 06331.
5. National Toggenburg Club
Alan J. Gillroy, Secretary, RFD Box 305, Mansura, Louisiana 71350.

C. National Dairy Goat Magazines

1. "Dairy Goat Journal"
Kent Leach, Editor, Box 1808, Scottsdale, Arizona 85252.
2. "The News Dispatch"
Published by the American Goat Society, Inc., Route 2, Box 112,
DeLeon, Texas 76444.

D. Dairy Goat Equipment Suppliers

1. NASCO
901 Janesville Avenue, Fort Atkinson, Wisconsin 53538.
2. American Supply House
P. O. Box 114, Columbia, Missouri 65201
3. Hoegger's Supply Company
P. O. Box 490232, "Dept. J," College Park, Georgia 30349.