3rd Annual Dairy Goat Conference

ST. PAUL STUDENT CENTER
UNIVERSITY OF MINNESOTA

November 8, 1980

3 RD ANNUAL DAIRY GOAT CONFERENCE PROCEEDINGS COMPILED AND EDITED BY: GERALD WAGNER, EXTENSION SPECIALIST, PROGRAM DEVELOPMENT, OFFICE OF SPECIAL PROGRAMS, UNIVERSITY OF MINNESOTA, ST. PAUL.

3RD ANNUAL DAIRY GOAT CONFERENCE

St. Paul Student Center
St. Paul Campus, University of Minnesota
November 8, 1980

Purpose

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

1. Select economical feeds and balance rations for does and kids.
2. Manage a herd health program for the dairy goat herd.
3. Produce quality dairy goat products.
4. Make the most of dairy goat products.
5. Get the most value from the veterinarian.
6. Judge and classify goats.
7. Determine forage quality.

Participants

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

Fee

$12.00 – includes proceedings and refreshments
$ 6.00 – for each additional family member
$ 6.00 – for University of Minnesota students

Lunch is available or you may bring your own.

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

For further information, contact the Office of Special Program at (612) 373-0725.

If you know of anyone who might be interested in attending the 3rd Annual Dairy Goat Conference, please pass the information in this brochure along to them.

Program

a.m.

7:30 Registration

8:00 For early arrivers

a. Use of DHI Records Workshop (for those enrolled or interested in DHI) – *Bill Mudge*

b. How a Goat Registry Can Serve You – *Paul Ashbrook*

Bob Appleman, presiding

9:00 Keynote Address
Solving Reproductive Problems Through Management – *Joan S. Bowen*

9:45 **Feeding Symposium**
Jim Linn, moderator

9:45 How I Feed Kids – *Maxine Sheldon*

10:00 Feeding the Goat Herd – *Tom Heeg*

10:30 Feeding Quality Forages – *Neal Martin*

11:00 Questions and Answers – *Symposium Panel*

11:30 Milk Quality and Home Pasteurization – *Vern Packard, Jr.*

12:00 Lunch

p.m.

Session I
Jeff Reneau, presiding

1:15 Problem Solving
How to Get the Most Value from Your Veterinarian – *Joan S. Bowen*

2:00 Hints on Using Your Veterinarian – *Robin Booren*

2:10 Hints on Using Your Veterinarian – *Glen Ziebarth*

2:20 Questions and Answers – *Panel*

Session II

1:15 Making the Most of Dairy Goat Products – *Tom Hicks*

Joint Session

3:00 Comparative Judging Techniques – *Dave Kowalski and Doug Thompson*

4:15 Discussion and Evaluation of Forage Samples – *Neal Martin*
(Note: Forage samples available for inspection)

4:30 Adjourn

Who's Who

+***Robert Appleman,** extension dairyman

Paul Ashbrook, director and past president of the American Dairy Goat Association, Portage, Wis.

Robin Booren, DVM, Marine on St. Croix, Minn.

Joan S. Bowen, DVM, Wellington, Colo.

+***James O. Hanson,** DVM, College of Veterinary Medicine

***Tom Heeg,** dairyman, North Central Experiment Station, Grand Rapids, Minn.

\+ **Jeannie Heine,** MDGA, Harris, Minn.

Tom Hicks, past president and treasurer MDGA, Clearwater, Minn.

\+ **Marge Kitchen,** MDGA, Grande, Minn.

Dave Kowalski, director, MDGA, Vergus, Minn.

+***James Linn,** extension dairyman

\+ **Vince Maefsky,** director MDGA, owner - Poplar Hill Goat Dairy, Scandia, Minn.

\+ **Christine Maefsky,** MDGA, Scandia, Minn.

***Neal Martin,** extension agronomist

***Bill Mudge,** extension dairyman

***Vern Packard, Jr.,** extension dairy products specialist

+***Jeff Reneau,** extension dairy specialist

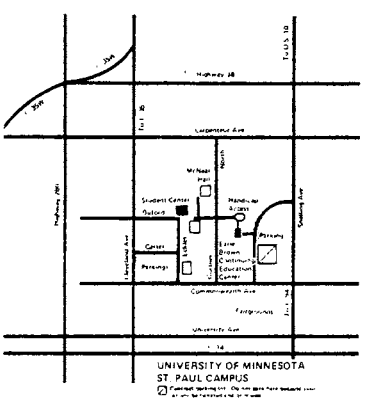
\+ **Maxine Sheldon,** MDGA, Marine on St. Croix, Minn.

Doug Thompson, president MDGA and ADGA judge, Clearbrook, Minn.

+***Gerald Wagner,** extension specialist, Program Development

Glen Ziebarth, DVM, Buffalo Veterinary Clinic, Buffalo, Minn.

**University of Minnesota*
+Planning Committee



3RD ANNUAL DAIRY GOAT CONFERENCE

TABLE OF CONTENTS

"SOLVING REPRODUCTIVE PROBLEMS THROUGH MANAGEMENT"

Joan S. Bowen

Reproduction in Goats

Improving reproductive efficiency in the goat begins with an understanding of the normal reproductive process and the problems which can befall it. Armed with this information, management systems can be adjusted to prevent these problems and therefore improve efficiency.

Goats in the northern hemisphere are seasonally polyestrous, exhibiting 18 to 48 hour estrous cycles every 18 to 21 days from September through January. Decreasing photoperiod and temperature are necessary for onset of breeding season, and anovulatory heats are common at both the onset and end of breeding season. Presence of an odorous buck will cause an earlier onset of estrus and can cause the whole herd to cycle within 8 to 10 days. Young does often exhibit irregular cycles of 6 to 12 days duration, while pregnant does may continue to exhibit signs of estrus throughout gestation.

The onset of reproductive capability varies from 2 to 7 months of age, and most does exhibit regular ovulatory heat cycles by 7 months of age. Young males will demonstrate normal sexual behavior as early as 2 months of age and are producing viable sperm by 6 months of age. As a result, young males and females should be separated by 2 months of age. For optimum growth and productivity, dairy doelings should not be bred until they reach a weight of 70 to 80 pounds, while Angora are not usually bred until their second year. Young males may be permanently stunted if used heavily their first breeding season.

Duration and symptoms of estrus vary greatly between does, but each normal individual will develop a consistent estrous pattern. Although estrus may last 18 to 48 hours, the doe will remain receptive or in standing heat for only the last 12 to 24 hours, and ovulate in the last 6 to 8 hours of estrus. Blatting, tail-flagging, anorexia, decreased milk production, nervousness, frequent urination, and the presence of red, swollen, lengthened vulva are all symptoms of estrus. Some does develop a thick, white, mucous discharge after estrus. The bloody discharge seen in cattle is rarely seen in the goat, and few does will mount each other as cattle will.

Application of extensive research on hormonal estrous induction and synchronization in sheep has resulted in successful attempts at manipulation of estrus in goats. During breeding season, does treated with progestogen impregnated vaginal sponges or subcuticular implants for 20 to 30 days will be in estrus within 2 days following removal of the implant or sponge. Outside normal breeding season the administration of 500 IU PMS and 250 IU HCG is necessary to induce heat following implant or sponge removal. Many different schemes involving daily injections of progesterone compounds followed by administration of PMS have proven successful and are discussed at length in Roberts, Veterinary Obstetrics and Genital Diseases, 1971. Although not cleared for use in goats and no dosages have been established, administration of prostaglandin F2 alpha in the presence of an active corpus luteum will induce estrus within 48 hours. Environmental schemes altering light to dark ratios have been developed because does supplying milk for human consumption cannot be treated with hormones. At Laurelwood Acres and Idelmar Farms, both bucks and does were placed in enclosed barns on a daily schedule of 16 hours of fluorescent light followed by 8 hours of darkness from February through April. In early May they were returned to normal lighting and commenced active breeding in late May, followed by kidding in October.

Good heat detection can markedly increase reproductive efficiency. Regardless of the physical condition of the does at the time of breeding, those does gaining weight during the weeks before and during breeding season will show more easily detectible heat and produce more ova than those not gaining. In herds where the males are run with the female herds, marking or breeding harnesses can be utilized for heat detection. Because the buck odor will flavor the milk, dairy does should not run with bucks, but should be housed within sight and sound of the scented males

so that estrous does will seek the buck and stand near his pen. Female psuedohermaphrodites and penectomized, vasectomized or deviated males may be utilized as teaser bucks. In herds without a buck, presence of a rag coated with buck scent can be utilized to detect heat and in some small herds may be utilized to synchronize heat. When does have a choice between an odorous or a descented buck, they will refuse the attentions and breeding of the descented buck. A routine of frequent observation of uncrowded does near odorous bucks and daily observation of the vulva are the best methods of heat detection.

A thorough physical examination and use of only healthy bucks can prevent the spread at breeding of several diseases such as brucellosis, sore mouth, abscesses, and chlamydia. Careful examination of the reproductive tract including palpation of the prepuce, penis, scrotum and testicles may reveal bucks with decreased fertility caused by trauma, tumors, cryptorchidism, psuedohermaphrodism, spermatic granuloma, gynecomastia, or testicular atrophy. Psuedohermaphrodism or intersex in goats is caused by a simple recessive, sex limited character associated with hornlessness or the polled trait. Female psuedohermaphrodites resemble males but lack male characteristics and have ovotestes and hypospadias. Horned psuedohermaphrodites may occur rarely, while congenital testicular hypoplasia is more common. Psuedohermaphrodism, testicular hypoplasia and atrophy are all evidenced by small, soft testicles and decreased libido. Incidence of psuedohermaphrodism can be decreased by careful mating schemes of horned to horned or polled to horned animals avoidance of mating polled to polled animals. Development of a functional mammary gland requires high blood levels of estrogen and progesterone which may interfere with normal testicular function. Therefore semen should be collected and examined from males exhibiting gynecomastia. The use of drugs on bucks within 60 days of breeding season or during breeding season must be carefully considered due to possible harmful side effects of the drug on sperm production, resulting in decreased fertility. Vaccination for enterotoxemia and tetanus, proper foot trimming, good nutrition and lots of exercise will put the buck into good condition to withstand the repeated stresses of breeding season.

Does should also be screened for contagious diseases that could be transmitted to the buck or their pregnant penmates. Examination of the vulva, vagina and cervix may demonstrate the presence of abnormal discharge indicating infection, which should be diagnosed and treated prior to breeding. The presence of pox infection or sore mouth may be evidenced by pustules on the vulva or tailhead. Does showing evidence of chlamydial infection should be treated before breeding or penning with pregnant does. Male psuedohermaphrodites which resemble females are not uncommon and are characterized by enlarged clitoral projections, masculine appearance, and failure to show estrus. There is no evidence to indicate that freemartinism occurs in goats. The cause of cystic ovaries, as evidenced by repeated short estrous cycles of 4 to 5 days duration or persistent heat, is unknown but may be influenced by high estrogen content in the feed or moldy feed. Guss reports that early treatment with IV 500 IU HCG may prove successful. Treatment with gonadotrophin releasing hormone may also be of benefit, but it is not cleared for use in goats and no dosage has been established. As with the bucks, routine vaccination for tetanus and enterotoxemia, good health care, frequent foot trimming, and good nutrition will prepare the doe for maximum production.

Proper management of both bucks and does at breeding is necessary to ensure a high conception rate. There are limitations in all males to the number of services possible in a given time period. Frequent repeated ejaculations over a relatively short period of time cause a reduction in sexual desire, semen volume and number of sperm per ejaculate. With repeated ejaculations the number of sperm per ejaculate decreases markedly. The first ejaculate may contain 3 billion sperm while the third ejaculate may contain less than .5 billion sperm. This becomes very important in outlining a good breeding program because semen characteristics are more severely affected by a high frequency of ejaculation in young immature bucks and they take longer to return to normal following sexual rest.

Owners of bucks commonly place an estrous doe in with the buck and leave her to be serviced repeatedly until out of estrus. This results in continuous services which reduce the amount of semen, the concentration of spermatozoa, and the conception rate.

By the time the doe ovulates 18 to 24 hours after onset of estrus, the semen is of poor quality and quantity. Because the ovum can survive in the oviduct up to 48 hours before being fertilized and sperm may survive only 18 to 20 hours, time of breeding is important. Therefore, conception rates can be increased by placing the estrous doe in the buck's pen, allowing one or two breedings, and then removing the doe from the buck's pen. The doe should be brought back to the buck every 12 hours until out of standing heat. This method results in a higher conception rate and incidence of twinning due to the different ovulation times of multiple ova. Approximately 70% of estrous does conceive following one natural service. Young bucks should not be used more than once or twice per week their first breeding season so that maximum growth may be obtained, while older bucks are capable of servicing 5 to 6 does per week. In range operations one mature male may service 50 to 100 does per breeding season. Range males may develop preferences for certain females, so that conception rates may be increased by rotating males through the female herds.

Artificial insemination in goats may some day offer a tremendous opportunity to improve both type and production and may eliminate the need for small herds to maintain costly bucks. However, due to the infancy of the industry and amount of labor involved in artificial insemination, its use is currently limited to an experimental basis in dairy goats. Theoretically, artificial insemination greatly increases the utilization of semen from proven, carefully selected sires who meet certain conformational standards and have the ability to transmit to their offspring correct type and an increased level of milk production. At this time, buck semen lists do not include this information, and no selection criteria have been developed to determine what constitutes a superior goat sire. Many of the goat semen processors have small operations that lack systems for quality control, disease control, and testing of semen. To date, there are no regulations governing semen quality and as a result, quality of semen purchased is extremely variable. Although most semen for artificial insemination is frozen, it may be practical to inseminate fresh semen collected from a buck incapable of servicing a doe.

Information published regarding techniques, equipment and timing of artificial insemination in goats is also quite variable. Due to long processing delays, semen should be ordered far in advance of breeding season. Due to variations in estrous behavior, does to be artificially inseminated should be observed through one or two estrous cycles before attempting insemination. Because conception rates using natural service are highest in October, November, and December, artificial insemination should be attempted during those months. Equipment for artificial insemination in goats includes: liquid nitrogen storage facilities, thawing equipment, glass tube speculum or human vaginal speculum, small light source, sensitive thermometer, lubricating medium, insemination pipettes for ampules or straws, and semen. Deep cervical insemination is necessary and is not difficult if the doe is in heat. Optimum time for artificial insemination is in the last 6 to 8 hours of estrus. The estrous doe is placed on a milking stand and restrained while a lubricated speculum is placed in the vagina. The cervix is located with the aid of a small light and the semen-filled pipette is manipulated through the cervix and the semen is expelled. Cervical size, ease of penetration, amount of dilation, and amount of mucous are all extremely variable. Some dealers recommend elevation of the doe's hindquarters for a few minutes following insemination. Conception rates of 30 to 50% can be expected following artificial insemination, and therefore artificial insemination should not be relied upon as the sole source of semen. If a doe fails to conceive after one or two attempts at artificial insemination, then natural service should be utilized.

A practical early method of accurate pregnancy diagnosis would be of great benefit to both owner and veterinarian. Ultrasound using the Doppler principle can accurately diagnose pregnancy at 28 to 45 days after breeding, but requires holding the doe off feed for 24 hours, placing the doe in dorsal recumbancy, expensive equipment, and special training. Radiographic examination of the abdomen will reveal an enlarged uterus after 35 to 45 days and fetal skeletons at 65 to 70 days, but is potentially harmful to the fetuses and is expensive. Measurement of plasma progesterone is unavailable commercially and again is expensive. Laparotomy

and peritoneoscopy are both expensive and impractical for routine use. New ultrasound devices based on density and requiring only the placement of an external probe on the right lateral attachment of the mammary gland can accurately diagnose pregnancy at 60 to 120 days and can be rapidly used on large herds, but they still require expensive equipment. Weekly tape measurement of the expanding abdomen from 60 to 90 days is an inexpensive method available to small herd owners. The Hulet technique using rectoabdominal palpation with a rigid plastic rod, is accurate at 70 to 110 days, but again requires that the doe be held off feed for 24 hours and placed in dorsal recumbancy. Ballottement of the fetus in the right flank is possible after 120 days gestation. Of the above techniques, only radiographic examination revealing fetal skeletons would positively rule out false pregnancy or "cloudburst." Pseudopregnancy is an uncommon consequence in which bred does fail to show estrus and progress to term, while milk flow decreases, the abdomen enlarges and pelvic ligaments relax. At parturition a large volume of clear fluid is delivered instead of kids and lactation may follow. Affected does will usually maintain a normal pregnancy and lactation the following year. At this time, observation of return to estrus during the breeding season remains the most practical method of pregnancy diagnosis.

The incidence of abortion in does is very high when compared with other domestic species and may terminate 15% of all gestations. Maintenance of pregnancy in the doe requires a functional corpus luteum throughout gestation and this may explain the high abortion rate. Noncontagious abortion is common among Angora and is associated with level of fleece production. Adrenal malfunction and lowered lutenizing hormone activity coupled with limited access to nutrients, stress and competition for nutrients between the growing fetus and mohair production cause abortions at 85 to 110 days gestation. Reduction of environmental stress, provision of adequate nutrients, and selection for lower mohair production will reduce the Angora abortion problem. Sheep and goats will interbreed, but the hybrid offspring are aborted at 60 to 90 days gestation.

Many infectious diseases are known to cause abortion in goats and many others are suspected. Listeria monocytogenes, which is associated with inapparent carriers or feeding of silage, causes abortion in the last third of gestation and is characterized by placental and fetal autolysis, focal necrosis of the fetal liver, retained placenta and severe metritis. Fetal loss due to Chlamydia is characterized by either early return to estrus or expellation of a fetal mummy or stillborn kid in the last two weeks of gestation. There is often a history of introduction of new stock or prior incidence of keratoconjunctivitis, pneumonia or polyarthritis. Few does abort more than once due to Chlamydia and administration of tetracycline may stop a chlamydial abortion storm. Leptospirosis and salmonellosis are uncommon causes of abortion in goats and immunization may be indicated inaffected herds. Coxiella burnetti and Toxoplasma gondii are also suspected of causing abortion in goats, but few cases have been documented. Approximately twenty thousand goats are tested annually in this country for brucellosis, in spite of the fact that the last known case occurred in Texas in 1958. There is no evidence that Vibrio fetus var. intestinalis is a cause of abortion in goats.

Noninfectious causes of abortion include chemicals, poor nutrition, trauma, and poisonous plants. Some anesthetics, phenothiazine, tetramisole, carbon tetrachloride, and nitrates cause abortion in late gestation. Abortion has been reported following consumption of lupine, locoweed, Veratrum californicum, sweet clover, onion grass, broomweed. Rough handl ng or fighting may also cause fetal death and abortion. Vitamin A deficiency, or deficiency of the minerals copper, iodine, phosphorous, and manganese, and starvation may also lead to abortion. In all cases, diagnosis of abortion should be based on a careful history, thorough physical examination of the doe, gross and microscopic examination of the fetus and placenta, uterine fluids and serum for culture and serology.

Besides abortion, other accidents of gestation include uterine torsion, vaginal prolapse, and uterine rupture. Uterine torsion, or revolution of the uterus on its long axis, may occur after falling or rolling when fetal fluids are decreased, or when animals receive inadequate exercise. A deep capacious abdomen and presence of multiple fetuses predispose a doe to uterine torsion. In late gestation uterine

torsion may cause symptoms of abdominal distress, but most cases are not diagnosed until dystocia occurs at parturition. Abdominal straining characteristic of the second stage of labor is absent because the twisted vagina prevents movement of fetal parts into the vagina. Vaginal examination of the doe is indicated when there is a history of prolonged first stage labor. Due to the twisted, narrow vagina, the fetus or cervix cannot be palpated. The prognosis for uterine torsion is usually good if the condition is diagnosed early before uterine rupture occur. Treatment consists of ceasarean section or rapidly rolling the doe in the direction of the torsion.

Prolapse of the vagina occurs when excessive relaxation of the vagina and pelvic ligaments allows increased intra-abdominal pressure to force the loosely attached vagina through the vulva. Over condition, inadequate exercise, or previous dystocia predispose a doe to vaginal prolapse. Prolapsed vagina does not necessarily lead to uterine prolapse, however prolapse of the vagina will recurr at subsequent pregnancies. Symptoms may vary from a mild protrusion of vaginal mucosa to a severe prolapse containing the urinary bladder. Prompt replacement of cleaned structures followed by suturing the vulva yields a favorable prognosis. The affected doe should be observed carefully for signs of impending parturition so that the sutures may be removed prior to delivery of the kids. Uterine rupture may occur spontaneously, or secondary to abortion, dystocia, emphasematous fetus, chronic peritonitis, torsion of the uterus or severe trauma. Symptoms of uterine rupture include acute abdominal distress, shock and death. Immediate surgical repair of a ruptured uterus should be accompanied by aggressive therapy for shock, including administration of fluids and corticosteroids. However, the prognosis following uterine rupture is extremely poor.

Pregnancy toxemia and milk fever are two metabolic diseases of goats which can occur during the last six weeks of pregnancy, parturition, and early lactation. Both of these diseases can be controlled with sound management and good nutrition.

Pregnancy toxemia, or ketosis, is caused by a disturbance of carbohydrate and fat metabolism associated with a falling plane of nutrition during late pregnancy. Sufficient nutrients must be present in the doe's diet for maintenance, milk production and fetal growth. When adequate nutrients are not available in the diet, impaired liver functions cannot meet the demand for glucose production and metabolism of fat breakdown products. Hypoglycemia, ketoacidosis, and presence of isopropyl alcohol cause the symptoms observed in pregnancy toxemia. Does that are overweight, have multiple fetuses, or that lack adequate exercise are predisposed to pregnancy toxemia. Extreme stress or sudden changes in management or feeding practices can precipitate the disease in otherwise does. The symptoms of pregnancy toxemia depend on the severity of the disease and vary from the mild form as evidenced by anorexia and depression, to the severe forms showing blindness, circling, head-pressing, paralysis, muscle tremors, convulsions, coma and death. Diagnosis is based on determination of elevated blood, urine or milk ketone levels. In pregnancy toxemia blood glucose levels may drop from the normal 60 mgm% to below 40 mgm%, and blood ketones may be ten times the normal 10 mgm%. Prompt treatment is necessary if the doe is to survive. Mild cases may respond to oral propylene glycol at 2 to 3 ounces per goat per day and the addition of concentrated energy sources such as corn or soybean. In severe cases, intravenous glucose, corticosteroids, and insulin are indicated, and caesarean section may be indicated in order to save the doe. Up to 50% of the does treated before the appearance of nervous signs recover, but recovery is unlikely after nervous symptoms occur. Prevention of pregnancy toxemia is based on good nutrition and sound management. All does should have a 60 day dry period between lactations and should receive ½ to 1½ pounds of concentrate ration per day. After kidding, a doe should receive 3 pounds of legume hay per 100 pounds body weight and 1 pound grain per 3 pounds of milk produced. All does should have access to free-choice clean water, salt, trace minerals, and baking soda.

Milk fever, or hypocalcemia, is caused by a disturbance in calcium metabolism which occurs most commonly at kidding in does with high milk production. During pregnancy, increased estrogen levels cause changes in the mobilization and absorption of calcium and phosphorous. The situation is further complicated when high calcium legume hay is fed. At parturition, the hormone

levels then revert to normal leaving the calcium metabolic pathway unable to meet the demand for calcium caused by lactation. Does during peak production years, producing a high butterfat content, or being fed a high calcium diet during the dry period, are the most susceptible to milk fever. Ingestion of high oxolate plants, stress or fasting may also cause the disease. Mild cases of milk fever may be evidenced by retained fetal membranes after kidding or difficult kiddings without physical cause. Excitability, muscle tremors, incoordination, coma and death are associated with severe cases. Physical examination of the hypocalcemic doe reveals a fast, shallow pulse, lack of milk in the udder, and a subnormal rectal temperature of 92 to 96 degrees F. Blood tests reveal a blood calcium level of less than 5 mgm% and diagnosis is often derived from a rapid, favorable response to calcium therapy. Treatment consists of slow, careful, intravenous administration of calcium borogluconate supplemented with phosphorous, glucose, and magnesium. Udder insufflation is not indicated except in extreme cases because it may cause severe mastitis. Relapse may occur unless calcium is also administered subcutaneously or intramuscularly. Prevention of milk fever consists of proper nutritional management of the pregnant doe. Pregnant does should be fed a high-energy, low-calcium diet during the dry period to maintain proper efficiency of calcium metabolism. Low calcium, non-legume hay and low calcium, high energy grain such as corn, wheat, milo and oats are preferable. Mineral supplements containing calcium should not be fed during the dry period. After kidding and throughout lactation, high calcium legume hay and high calcium grains such as soybean, linseed, or cottonseed meat should be fed.

Parturition is one of the most critical stages in the life of any animal and is associated with a high death rate. Familiarity with the stages of normal parturition results in immediate recognition of abnormal parturition and allows time for assistence before the doe or kids are endangered. Length of gestation may vary from 140 to 160 days with an average of 150 days, and an accurate breeding date is helpful in determining whether or not parturition is about to occur. Relaxation of the pelvic ligaments and vulva occurs in the last weeks of gestation and the mammary glands develop in the last month of gestation, secreting milk in the final week of pregnancy. The first stage of labor is characterized by mild uterine contractions and dilation of the cervix and may last from 1 to 4 hours. During this time, the doe may become anorexic, strain occasionally, and show signs of abdominal discomfort. The second stage of parturition is characterized by entrance of the kid into the vagina causing strong abdominal contractions, rupture of the allantoic sac, and expulsion of the kids. If labor does not progress from mild to strong contractions, then the doe should be examined vaginally as uterine torsion or the breech presentation will prevent movement of fetal parts into the vagina. The first kid will usually be delivered within one hour following the onset of strong abdominal contractions and multiple kids usually follow one another quite rapidly. The third stage of parturition is the expulsion of the placenta and this should occur within 8 hours following parturition. Rate of involution of the caprine uterus is unknown, but a brownish lochial discharge may persist normally for 2 to 3 weeks postpartum.

Does may often require assistence at parturition due to maternal-fetal disproportion or malpresentation. Dystocia is more common in small, corralled, overconditioned, and underexercised herds and in small, poorly grown does. Both anterior and posterior presentation are considered normal, but many malpresentations are possible, including breech, lateral deviation of the head and neck, retained limbs, dorso-pubic rotation and transverse rotation. Vaginal examination is indicated when a kid is not delivered within one hour following onset of strong contractions. The exact presentation of the kid should be determined before manipulation is attempted. Both legs and/or head should be attached to the same kid, as a common error is to pull on legs from two different kids. Correction of the various malpresentations is the same as for cattle, but care should be taken to avoid force and excessive trauma. After pulling one kid, always reexamine the doe for further kids, as these quite often must be pulled. Intrauterine or intramuscular antibiotics are indicated after correction of dystocia for

prevention of postpartum metritis. In the course of dystocia in the goat, the cervix may fail to dilate initially. Due to the inability to manually dilate the partially closed cervix, caesarean section is indicated. Any dystocia that is not easily and rapidly corrected vaginally should be corrected by immediate caesarean section, which may be readily and easily performed under local anesthesia in the left paralumbar fossa.

Problems of the postpartum period include retained placenta, metritis and uterine prolapse. Severe post partum hemorrhage is uncommon in the doe but can be controlled by administration of 10 to 20 units of oxytocin, direct pressure or ligation. Does should be examined for laceration of the vagina, vulva or cervix following dystocia, and these conditions should be corrected surgically. Post parturient paresis of the obturator or peroneal nerves is also rare, but may respond to good nursing care. Prolapse of the uterus may occur in does exhibiting persistent straining, prolonged dystocia, retained placenta or excessive relaxation of the perineal region. Symptoms of shock often accompany prolapse of the enlarged, edematous uterus. Epidural anesthesia, elevation of the uterus, and elevation of the hindquarters make replacement of the cleaned uterus easier. Administration of oxytocin and intrauterine antibiotics is indicated, and vulva sutures may be necessary to prevent recurrence. Prognosis of future breeding capability depends on the severity of uterine lesions, promptness of treatment, and rate of involution. Retained placenta occurs following parturition in unclean surroundings, abortion, dystocia, intrauterine infection during gestation, or uterine inertia. Manual removal of the retained placenta is contraindicated and the placenta should be allowed to fall away of its own accord. Intrauterine or parentaral antibiotics are indicated and prognosis is very good. Post partum metritis in the doe is associated with uterine inertia and the presence of pathologic organisms in the uterus. Metritis may follow dystocia, retained placenta, prolapsed uterus or kidding in unclean areas. Post partum metritis in the doe is indicated by anorexia, depression, markedly elevated temperature, toxic mucous membranes, and rapid loss of condition. There is evidence of a purplish-red, gelatinous uterine discharge. Treatment consists of irrigating the uterus with a mild antiseptic in saline solution, intrauterine infusion of antibiotics, and good nursing care. Prognosis is favorable following prompt treatment. True pyometra is rare in the goat.

Embryo transfer from genetically superior does to surrogate does may be a useful genetic tool in the future. Techniques for induction of multiple ovulation, or superovulation, and surgical transfer of embryos have been developed for use in the goat. Using current techniques, non-surgical transfer or recovery of embryos is not possible due to the tortuous nature of the caprine cervix. Embryo transfer is an extremely expensive venture and the benefits to be gained versus risks of surgery must be carefully considered.

HOW I FEED KIDS

Maxine Sheldon
Owner
Maple Island Alpines

This information is not derived from research or specific publications, but is based on my experiences of kid feeding gleaned from trial and error methods.

There are basically three methods of kid feeding of which I am aware. They are (1) kid nursing dam, (2) bottle/pan feeding, and (3) continuous cold milk feeding. The first method of letting kids nurse dams was unacceptable for me because of does producing too much milk, increased frequency of mastitis due to udder trauma and kids favoring one side, and inability to wean kids without total separation for a very long period of time. I have not tried the third method due to lack of equipment and space. The method I have found to meet our needs is the second method of bottle feeding.

With newborn kids, I like to have as many things going for the kid as possible. To accomplish that I try to be present at the time of kidding to get the kid warm and dry and dip its umbilical cord in iodine. I leave the kids with the dam for the first twenty-four to thirty-six hours. During this time, I try to get the kid to nurse as soon as possible to provide nourishment and stimulation for the kid and to encourage the doe to pass her placenta. The first milk that the dam produces is colostrum, which the kid needs to survive. The colostrum is a laxative, high in carotene, protein and other nutrients, as well as antibiotics which are necessary to the kid's growth and protection from infection.

During this time, I observe for normal urination and stooling. At this stage, the stools should be black and tarry but by two or three days it should be soft and yellow. Leaving kids on the dam for more than thirty-six hours makes training to the bottle very difficult. When the kids are nursing the dam, you should check the condition of the udder at least twice daily. If the udder is hard, congested and inflamed, the doe needs to be milked and her udder massaged. We do not milk our does empty for the first twenty-four hours.

At thirty-six hours I separate the dam from the kids and do not

feed the kids for twelve hours. By insuring the kids are hungry, they are usually more cooperative for nipple training. Usually by the second feeding they have mastered the nipple.

I start out feeding three times a day at six hour intervals. I start with four (4) ozs. of milk per feeding. When I know that amount is being tolerated with no scouring and the kid displays a desire for more to eat, I increase the amount of the feeding by two (2) ozs. I remain at that increase for a minimum of two feedings before I increase again. At four days of age, I start offering warm water in the nipple bottle at the completion of the milk feeding, and let them drink as much water as they desire. I continue on this schedule until the kid is taking three pints of milk per day, which is usually about three weeks of age.

For the next week, I don't increase their milk intake, but I take two ozs. off their noon feeding and increase the morning and evening feedings by that amount, until the noon feeding is discontinued. At this time, I also start placing a water bucket of warm water in the pen at the time they would previously received their noon bottles. The kids usually teach themselves to drink from the bucket in about a week. After they are comfortable with this schedule, I then discontinue the water bottles after their milk feedings, and let them take all of their water by pail.

I then resume increasing their milk intake by two ozs. for as long as it is tolerated until the kids are receiving one quart of milk per feeding, or a total of one-half gallon per twenty-four hours. When the kids drink well from the pail, I switch from nipple feeding milk to pail feeding. I feed milk until the kids are three to four months of age, unless they wean themselves earlier. As the kids increase the amount of forage and grain they consume, their desire for milk may decrease, and I feed them what amount they will drink.

If the kids are still drinking more than one quart of milk per day and it is time to wean them, I start replacing part of the milk with water until I have gradually ended the milk. Sometimes I gradually end the evening feeding, and then the morning feeding, instead of both at the same time.

When hand raising kids, excellent sanitation must be practiced. All bottles, nipples, pails, funnels, measuring cups and any other equipment used should be rinsed in tepid water, then washed in a good dairy detergent and sanitized, after each feeding. Most digestive upsets can be prevented with diligent sanitation.

Guessing the amounts of milk can also be very deceiving. Always measure and be sure, and keep a written record of their

intake after each feeding. Don't trust your memory. You will kill your kids faster by over-feeding and scouring them, then by any other way.

As you can see, the milk feeding requires more work and concern than the grain and forage, but that doesn't mean grain and forage are not important. Grain and a good quality forage should be fed along with their milk. I start feeding a 20% protein calf starter at ten days to two weeks of age. I feed free choice and their first nibbles soon turn to serious consumption of their grain. When I start feeding grain, I also start feeding alfalfa hay free choice. They soon learn the best part is the leaves and ignore the stems, just like their spoiled dams. A few days after they have started consuming grain and forage, you should notice them chewing their cuds when at rest.

As with the milk, grain and forage should be fed in as clean a way as possible. Grain should be fed in a feed trough that cannot be used for napping or king-on-the-hill, and which can easily be cleaned. Hay should never be fed off the floor, but from a hay rack. Just be careful of cracks and crevices that can catch and injure hooves and heads.

After your kids are weaned and on a diet of grain, forage and browse, I continue to feed hay free choice for the remainder of their life, and I feed two to four pounds of dairy grain daily until they freshen. The best judge of whether or not you need two or four pounds of grain daily is the appearance of your kids. Keep them in good condition, but don't let them become fat.

At the time you begin feeding grain and forage, you should also feed salt and minerals free choice. Have your feed person advise you on the type of minerals to feed with your specific type of grain and forage that you are feeding.

We feel one of the advantages of this type of feeding system is the ability to put your kids in the herd with their dams after ten days to two weeks and they are unable to identify each other. It also seems toproduce a kid who loves people because you are their mother figure. The kids will think of you as their friend forever and will usually be more than willing to be a cooperative, even tempered animal in the milk parlor.

I would like to close with the reminder that this method of feeding is not necessarily the best way for you to handle your kid crop, the only thing I can say about the above regimen is that it has worked well for Maple Island Alpines.

MAPLE ISLAND KID FEEDING SCHEDULE

Milk

Age	Method	Amount	# Feedings per day
Birth-36 hrs.	nurse dam	free choice	free choice
36 hrs.-2 days	nipple bottle	4 oz.	3
2 days-3 weeks	nipple bottle	4 oz.-3 pts. per day	3
3 weeks-5 weeks	nipple bottle	3 pts.-2 qts.per day	2
5 weeks-3/4 mons.	pail	2 qts. or less	2
3-4 mons.	pail	gradual decrease	1
4 mons.	weaned		

Water

4 days	nipple bottle	free choice	3
3-5 weeks	pail	free choice	free choice
5 weeks-adult	pail	free choice	free choice

Grain

10 days-2 weeks	trough/pail	free choice	free choice
3-5 mons.	trough/pail	2-4# per day	2
5 mons.-freshen	trough/pail	2-4# per day	2

Hay

10 days-adult	hay rack	free choice	free choice

FEEDING THE GOAT HERD

Thomas R. Heeg
Assistant Professor
North Central Experiment Station
Grand Rapids

Proper feeding is a very important aspect of an overall dairy goat program. Although the nutritional requirements of the dairy goat have not been examined as closely as they have for other classes of livestock, we have a fairly good understanding of the basic requirements for maximizing growth, production and efficiency.

FEEDING YOUNG KIDS

It is very important newborn kids receive colostrum shortly after birth. Colostrum is an excellent food for the newborn kid, not only because of its high concentration of nutrients, but also because it contains antibodies which are very helpful in warding off diseases early in the kid's life. After freshening, make sure the doe has produced colostrum, and check to see that the teats are clean and the teat canal is free of obstructions. Some first milking colostrum should be frozen and kept on hand in case a doe dies, or does not produce sufficient quantities of milk.

Kids can be raised on goat's milk, cow's milk, or a high quality milk replacer. They should be fed 2 to 4 times a day. At 3 weeks of age a calf starter ration and good quality hay should be offered in small quantity. Increase the amount of dry feeds offered as time progresses. When the kids are consuming hay and grain in good quantity they may be weaned, usually at about 3 months of age.

FEEDING YEARLINGS

Young growing goats should have unlimited access to good forage, whether it be hay, silages or pasture. In addition, feed approximately 1 lb of concentrate per day. The condition of the young goats should be closely monitered, with special emphasis being placed on not overconditioning the goats. Excess fattening will decrease their reproductive efficiency as well as decrease their potential for milk production. If the goats are grazing relatively poor pasture, a 50:50 mixture of loose trace-mineralized salt and dicalcium phosphate should be available to them.

FEEDING THE PREGNANT DRY DOE

During the dry period the doe should be maintained in good condition, with enough feed to replace weight lost during the lactation. Good quality forage plus a small amount of concentrate mixture (1/2 to 1 lb daily) should be adequate. Avoid overfattening the animal, as this will lead to problems at parturition. It is very important the dry doe receive concentrate mixture (1 to 1-1/2 lbs daily) during the last 4 to 6 weeks of gestation. During this time the unborn kids are putting on about 70%

of their weight. If the doe is carrying twins or triplets, she cannot mobilize enough energy from her own body reserves. If the doe is not receiving adequate energy (concentrate) in the ration, pregnancy toxemia is likely to occur. If the doe becomes listless and goes off feed, a propylene glycol drench should be administered. Prevention is a much more successful alternative.

FEEDING THE BREEDING BUCK

The breeding buck is obviously a very important factor in the goat herd. When not being used for breeding, good pasture or hay plus a limited amount of concentrate mixture (1/2 to 1 lb) will maintain the buck in good condition. A 50:50 mixture of trace-mineralized salt and dicalcium phosphate offered free choice is always desirable in the barn or pasture.

Feeding excessive amounts of grain when the buck is inactive may cause him to become fat, sluggish and decrease his breeding efficiency. Two weeks before and during the breeding season, increase the amount of grain fed 1 to 2 lbs daily or more if the buck is large and is covering a large number of does. Poor quality hay can be especially low in nutrients such as phosphorus and vitamin A. These nutrients are very important in maintaining high fertility. For these reasons good quality feeds should always be fed.

FEEDING THE LACTATING DOE

If high persistant production is expected from your does, a sound feeding program is a must. Many different feeds can be utilized. Using home-grown forages and grains, or those that can be purchased at the least cost per unit of energy and protein will minimize feed costs.

If high quality forage is fed, the grain mixture should contain about 14% crude protein. As roughage quality decreases, the protein level of the concentrate needs to increase to 16 or even 18% crude protein. Listed below are examples of simple rations for dairy goats.

Ingredient	Approximate Percent Crude Protein		
	14%	16%	18%
Cracked corn	37	35	32
Rolled oats	37	35	32
Wheat bran	16	14	15
Soybean meal	9	15	20
Dicalcium phosphate	.5	.5	.5
Trace mineral salt	.5	.5	.5

The grain mix should be fed at the rate of 1/3 to 1/2 lb of grain per lb of milk produced. Does producing 12 or more lbs of milk may be fed to appetite. Since forages and grains don't always supply enough vitamins, 3000 units of vitamin A and 300 units of vitamin D daily should be added to the grain mix of goats confined indoors.

GENERAL RECOMMENDATIONS

Physical form of the grain mixture is important. Dairy goats prefer grain that is coarsely cracked or rolled. A minimum of dust and fines is desirable. If the feed is dusty, the addition of 5% liquid molasses will make it more acceptable. Avoid moldy grains and forages, as they are not as palatable and may cause digestive upset.

A very important factor for all ages of dairy goats is a continuous source of CLEAN, fresh water. Goats are much fussier regarding their drinking water than other farm animals. If at all possible, a nipple type waterer is more desirable than tanks or troughs.

FEEDING QUALITY FORAGES TO DAIRY GOATS

Neal P. Martin
Extension Forage Agronomist
Department of Agronomy and Plant Genetics

Feeding dairy goats a well balanced ration is required if goats are to produce large amounts of milk and grow at a normal rate (Hutjens, 1978). The quality of the forages used in formulating such a ration dictates the amount of forage fed, amount of grain fed and the percentage crude protein in the grain mix. Thus, a precise knowledge of nutrient availability in forages is required by goat managers.

QUALITY MEANS NUTRIENTS

The quality parameters needed to assess nutrient availability are percent age dry matter (DM), percentage crude protein (CP) and an estimate of fiber concentration. Most commercial laboratories routinely test forages for crude fiber (CF), but new forage testing procedures and a proposed hay market grade suggest analyzing forages for acid-detergent fiber (ADF) and neutral detergent fiber (NDF) which are preferred over CF. However, rations can be accurately formulated when DM, CP, and CF values of forages are known. CF or ADF is used to estimate total digestible nutrients (TDN) or net energy for lactation (NE_L).

Forages that undergo heat-damage during storage often have less of the crude protein available to the animal. Therefore, an acid-pepsin or acid detergent fiber-nitrogen (ADF-N) test can be run to determine protein digestibility.

This presentation will deal with assessing the DM, CP and fibrous portions of forages.

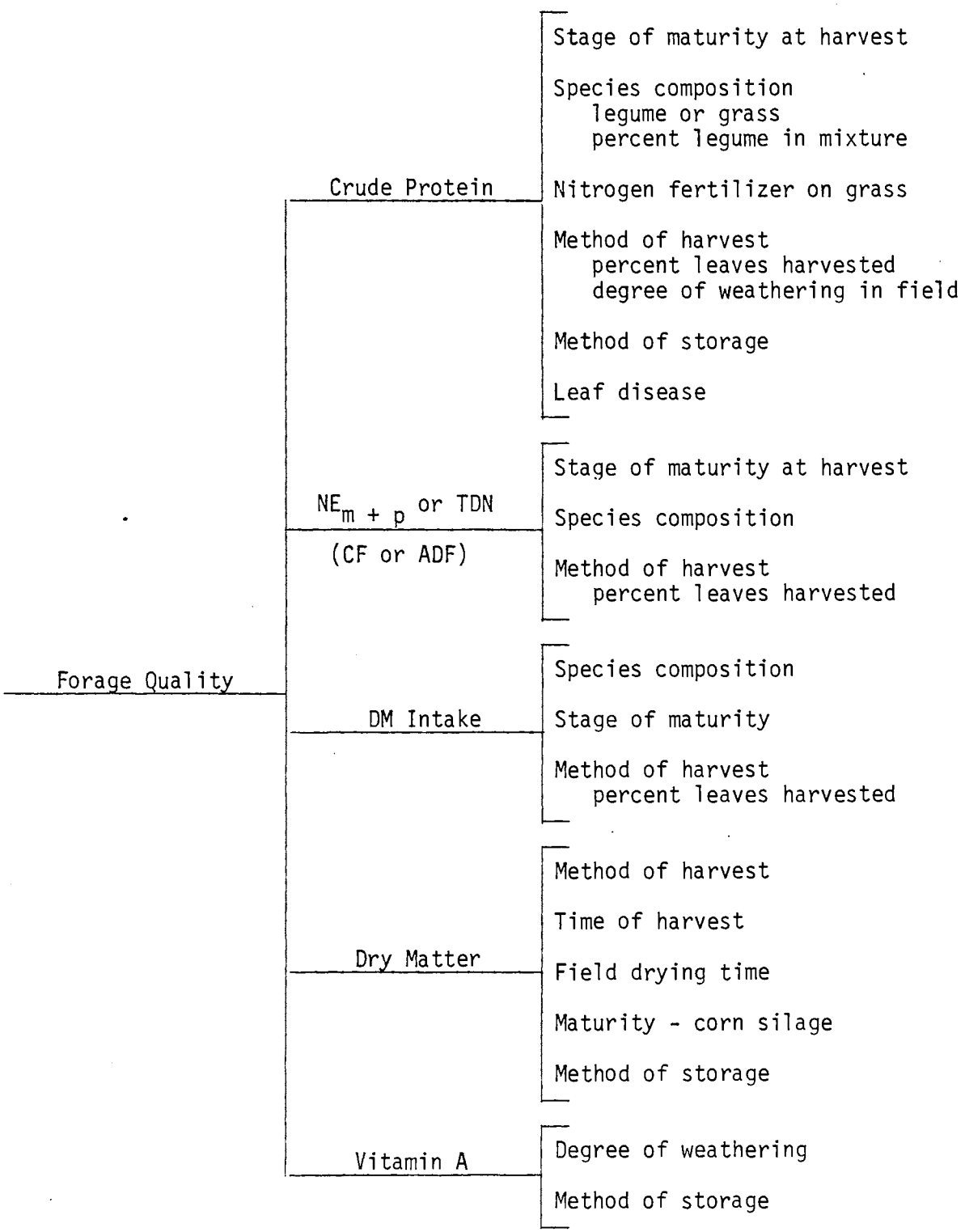
FACTORS AFFECTING FORAGE QUALITY

Protein and energy values of forages vary widely. Forage quality is influenced by stage of maturity, species composition, fertilization, method of harvest, method of storage and leaf disease or insect damage, Figure 1. All except the latter will be discussed to enable goat managers to correctly assess the protein and energy concentrations of forages used in a dairy goat ration.

Stage of Maturity

As forage crops mature the fiber concentration of the plant increases. The fibrous portion of plants is relatively indigestible and as maturation advances the fiber portion of plants, particularly lignin increases. Lignin is totally indigestible by rumen microbes. Fiber concentration is inversely related to energy digestibility or TDN. Thus, as plants mature, CF concentration increases and TDN concentration decreases. Interestingly, CP decreases

Figure 1. Factors which influence forage quality.



as plants mature. The data in Table 1 indicate that CP and ADF change drastically in first and second cutting alfalfa as stage of maturity advances.

Table 1. Yield and quality of alfalfa as influenced by stage of maturity. Average of three years at Rosemount.

Date of cut	Days after previous cut	Maturity range	DM T/A	CP %	ADF[1/] %	TDN %
		1st cut				
5/26		veg	0.8	26.9	25.0	61.0
6/2		veg - p. bud	1.2	24.0	31.4	59.9
6/9		p. bud - bud	1.6	21.4	36.2	56.4
6/16		bud - 25% bl	1.9	19.8	39.8	52.2
6/23		25 - 75% bl	2.4	16.8	42.0	49.1
6/30		f. bl - seed	2.6	16.6	45.0	44.0
		2nd cut				
7/15	29	10% bl	0.7	26.9	28.3	60.9
7/21	36	20 - 50% - bl	1.1	20.8	34.8	57.6
7/28	42	55 - 75% - bl	1.2	20.4	36.4	56.2
8/4	49	87% - f. bl	1.3	17.7	38.3	54.1
8/11	56	seed	1.4	16.3	40.0	52.0
		3rd cut				
8/9	20	veg	0.4	26.4	24.3	60.9
8/16	27	veg - bud	0.6	23.0	26.0	61.1
8/23	34	bud	0.6	22.8	29.0	60.8
8/30	41	bud	0.8	21.3	28.7	60.8
9/6	48	5% bl	1.0	19.2	31.2	60.0

1/ ADF = (CF ÷ .75) - 3.56.

SOURCE: Adapted from Martin and Marten. 1975. and Moline and Wedin. 1963.

ADF values increased faster per day in the first and second cut than CP decreased. However, both parameters change little with date of cut on the third cut. Similar changes in CP occur with cool-season grasses. Note that as frequency of cutting of four species of cool-season grass increased, Table 2, the CP and *in vitro* digestible dry matter (IVDDM) decreased.

Stage of maturity influences quality of annual crops used for silage, too, but differently than in perennials. Corn or sorghum silage provides its highest TDN concentration when crops are harvested at maturity, whereas higher TDN is obtained at immature stages in perennials. Stage of maturity has little influence on CP concentration in corn or sorghum silage.

Table 2. Influence harvest schedule on crude protein, in vitro digestible dry matter (IVDDM) and neutral detergent fiber (NDF) of four cool-season grasses averaged over 3 harvest years at Rosemount, MN.

Species	Crude protein			IVDDM			NDF		
	Cuttings per year								
	2	3	4	2	3	4	2	3	4
	% dry weight								
Orchardgrass	12.7	14.8	16.5	61.4	66.9	69.6	58.2	55.1	52.1
Tall fescue	12.9	13.8	15.5	61.1	65.4	69.1	57.9	55.2	52.5
Reed canary-grass	13.2	16.9	21.0	55.7	61.7	68.7	56.8	54.8	49.1
Smooth bromegrass	14.0	16.6	20.2	58.9	66.5	69.8	56.4	54.9	50.1

SOURCE: Marten and Hovin. 1980. Agron. J. 72:378-387.

Species Composition

Quality of hay made from grass-legume mixtures will vary based on the proportion of legume or grass. Grasses not fertilized with nitrogen (N) will analyze lower in CP than legumes. The data in Table 3 show that greater than 50 percent legume in a clover-grass mixture or pure alfalfa analyzed higher in CP than in alfalfa-grass mixture containing only 22 percent legume.

Legumes contain a lower percentage of cell wall constituents, estimated by NDF, than grasses. Cell wall constituents are related to feed intake. Hence, the higher the proportion of legume in a mixture, the more DM the animal will consume when offered forage free choice.

Table 3. Yield, botanical composition and crude protein of selected legume-grass mixtures averaged over 2 harvest[1/] seasons at Grand Rapids, MN.

Legume-grass combination	Fertilizer[2/]	DM T/A	Legume %	Grass %	Crude protein %
Clover-grass	P&K	3.2	54	48	20.5
Alfalfa-grass	P&K	1.8	24	76	15.8
Pure alfalfa	P&K	1.8	74	6	19.3
Pure grass	P&K	2.0	0	89	14.4
Pure grass	N[3/] &P&K	3.5	0	94	20.2

1/ Year 1, 3 cuts; year 2, 4 cuts

2/ Soil required lime for alfalfa, but was not applied

3/ 200 lbs N/A applied in two applications, split equally.

SOURCE: Schmid and Rabas. 1975-76. Unpublished.

Species also vary in their rate of maturation. In cool-season grasses, maturation rate is fastest with orchardgrass and tall fescue, followed by smooth bromegrass, reed canarygrass and timothy. Maturity differences are noted in the lower IVDDM of reed canarygrass and smooth bromegrass than in the other two species, Table 2. In legumes, alfalfa is earliest followed by red clover and birdsfoot trefoil.

Therefore, the composition of a mixture influences the forage quality of hay. The primary gauge of a quality difference is legume vs. grass followed by maturation of each species.

Fertilization

N fertilizer improves CP concentration of cool-season grasses. The data in Table 3 indicate that 200 lbs N/A/yr increased the percentage CP in cool-season grasses enough to equal the CP value for the clover-grass mixture. N fertilization also increases CP of warm-season grasses (switchgrass, indiangrass, sorghum-sudangrass or sudangrasses).

Application of phosphorus (P) or potassium (K) will increase the concentration of each mineral, but in general will not significantly influence protein or energy concentrations of perennial forages. However, maintenance applications of P and K are needed on legumes to prevent invasion of weeds into stands over time.

Method of Harvest

Leaves of legumes or grasses analyze higher than stems in protein and energy. Therefore, the method of harvest that collects the highest proportion of leaves results in highest quality forage. Weather conditions during curing of hay often influence the quality of hay harvested. Rain will leach protein and other soluble compounds from plants during field curing, but in general the time forages lay in the field and the number of times hay is mechanically turned before baling influence quality more than leaching. Also, rain damage will bleach the green color from hay, but this only results in a loss of vitamin A.

During heavy rain conditions, usually early June and July in Minnesota, silage or haylage harvesting can result in better quality forage than hay because the field drying time is reduced.

Method of Storage

Proper storage conditions are needed to maintain the nutrient composition forages have when they are harvested. Hay is stored under aerobic (presence of oxygen) conditions. Hay must be stored inside at 15 percent moisture or less to prevent formation of molds during storage. Vitamin A and soluble carbohydrates will be lost during mold formation in hay, but protein concentration and energy digestibility are not changed.

Storage life will influence vitamin A content more than protein or energy. Green color is an indicator of vitamin A content. Thus, two-year-old hay that is bleached but stored at the proper moisture concentration should only need supplementation of vitamin A.

Weathering of large hay packages stored outside will reduce protein and digestible energy. Losses during one year of storage have ranged from 5 to 10 percent, but these losses often double during the second year of storage.

SELECTING FORAGES FOR THE RATION

A 140-lb goat producing 6 lbs of milk at 4.0 percent fat was fed 3 lbs of hay and 3 lbs of grain. Based on the nutrient requirement addressed by Hutjens, the example below demonstrates how these different hays fit the protein and energy requirements of this milking doe.

	TDN (lb)	Protein (lb)
Requirements		
Maintenance	1.75	.38
Milk production	1.98	.47
	3.73	.85
Feed		
3 lbs of grain	2.22	.42
Balance needed	1.51	.43
3 lbs of Forage A	1.77	.54
3 lbs of Forage B	1.32	.36
3 lbs of Forage C	1.69	.45

Forage A: CP, 18%; TDN, 59%. Forage B: CP, 12%; TDN, 44%. Forage C: CP, 15%; TDN, 56%.

Many options exist to correct the excesses or shortages created with these forages. The forage intake can be increased, the protein in the grain mix changed, or level of grain feeding changed. However, accurate knowledge of the quality of these hays is essential. Each of the quality analysis represented in Forages A, B, and C can be found in pure alfalfa, pure grass or in an alfalfa-grass mixture. Therefore, how does one accurately estimate quality?

METHODS OF ASSESSING QUALITY FORAGE

Organoleptic

The most commonly used method of assessing forage quality is organoleptically. An organoleptic analysis is the scientific term for using your human senses of touch, sight and smell to assess the quality of forage. Experienced managers can detect percent legume vs. grass, stage of maturity of each, leafiness and color. Using a knowledge of information available in Tables 1, 2, and 3 protein and energy is estimated. However organoleptic guesses can be misleading.

Forage Test

Sampling representative forages for forage testing is the best method of assuring precision of protein and energy. Obtaining a representative sample dictates the accuracy of your analysis. Hay should be sampled with a hay probe. Take one core from each of 10 to 12 rectangular bales. Mix these cores and send to a commercial laboratory for analysis. Analysis of DM, CP, and CF will provide you an estimate of moisture concentration, protein and TDN.

Hay Grade

Recently the American Forage and Grassland Council has proposed a new system to grade hay for market. They are proposing five grades of hay based on two fiber tests - ADF and NDF. Tables 4 and 5 provide the ranges of ADF and NDF needed for each grade. CP and physical characters are included for your information, but are not needed to establish the grade.

Table 6 shows animal parameters that the fiber tests provide. These parameters - digestible dry matter (an estimate of energy digestibility) and DM intake - are used to establish the relative feed value. Note that the best quality grass is not as good as the best legume Grade 1 vs. 2. This is because of the intake factor.

Table 6. Hay market grades with predicted animal performance parameters.

	Legume		Grass	
Grade	Digestible dry matter, %	Dry matter intake, lb[1/]	Digestible dry matter, %	Dry matter intake, lb[1/]
1	>70	>37	-	-
2	66-70	33-37	>72	>33
3	58-65	31-33	62-72	30-33
4	<58	<31	55-61	22-30
5	-	-	<55	<22

[1/] Lbs of dry matter per 1300 pound cow.

SOURCE: Adapted from Rohweder and Baylor. Forage and Grassland Progress. Vol XX. Winter 1980. pp. 2-4.

This grading method has not been accepted by the Federal Grain Inspection Branch of the Agricultural Marketing Service. A major limitation to the method is the long time required to obtain test results. However, a testing technique called infrared reflectance spectrocomputer analysis has been shown to be a rapid method of analysis. It can provide a fiber analysis, hay grades and balanced rations within minutes after a sample is taken. The technique is now being evaluated for its accuracy.

PRICING FORAGES

Not only is the quality of forages variable but the method of pricing forages

Table 4. Proposed market hay grades for legumes and legume-mixtures (Hay Marketing Task Force)

Grade	Stage of maturity inter-national term	Definition	Physical description	Typical chemical composition--percent* CP percent	ADF percent	NDF percent	Relative feed value percent
1. Legume hay	Pre-bloom	Bud to first flower; stage at which stems are beginning to elongate to just before blooming.	40 to 50 percent leaves†; green; less than 5 percent foreign material; free of mold, musty odor, dust, etc.	>19	<31	<40	>140
2. Legume hay	Early bloom	Early to mid bloom; stage between initiation of bloom and stage in which 1/2 of the plants are in bloom.	35 to 45 percent leaves†; light green to green; less than 10 percent foreign material; free of mold, musty odor, dust, etc.	17-19	31-35	40-46	124-140
3. Legume hay	Mid bloom	Mid to full bloom; stage in which 1/2 or more of plants are in bloom.	25-40 percent leaves†; yellow green to green; less than 15 percent foreign material; free of mold, musty odor, dust, etc.	13-16	36-41	47-51	101-123
4. Legume hay	Full bloom	Full bloom and beyond.	Less than 30 percent leaves†; brown to green; less than 20 percent foreign material; free of musty odor, etc.	<13	>41	>51	<100

6. Sample Grade
Hay which contains more than a trace of injurious foreign material (toxic or noxious weeds and hardware) or that definitely has objectionable odor or is under cured, heat damaged, hot, wet, musty, moldy, caked, badly broken, badly weathered or stained, extremely overripe, dusty, which is distinctly low quality or contains more than 20 percent foreign material or more than 20 percent moisture.

* Chemical analyses expressed on dry matter basis. Chemical concentrations based on research data from NC and NE States and Florida. Dry Matter (moisture) Concentration can affect market quality. Suggested moisture levels are: Grades 1 and 2 < 14 percent. Grade 3 < 18 percent, and Grade 4 < 20 percent.

† Proportion by weight.

SOURCE: Rohweder and Baylor. Forage and Grassland Progress. Vol XX. Winter 1980. pp. 2-4.

Table 5. Proposed market hay grades for grasses and grass-legume mixtures (Hay Marketing Task Force)

Grade	Stage of maturity international term	Definition	Physical description	Typical chemical composition--percent* CP† percent	ADF percent	NDF‡ percent	Relative feed value percent
2. Grass hay	Pre-head	Late vegetative to early boot; stage at which stems are beginning to elongate to just before heading; 2 to 3 weeks' growth#	50 percent or more leaves**; green; less than 5 percent foreign material; free of mold, musty odor, dust, etc.	>18	<33	<55	124-140
3. Grass hay	Early head	Boot to early head; stage between late boot where inflorescence is just emerging until the stage in which 1/2 inflorescences are in anthesis; 4 to 6 weeks' growth#	40 percent or more leaves**; light green to green; less than 10 percent foreign material; free of mold, musty odor, dust, etc.	13-18	33-38	55-60	101-123
4. Grass hay	Head	Head to milk; stage in which 1/2 or more of inflorescences are in anthesis and the stage in which seeds are well formed but soft and immature; 7 to 9 weeks' regrowth#	30 percent or more leaves**; yellow green to green; less than 15 percent foreign material; free of mold, musty odor, dust, etc.	8-12	39-41	61-65	83-100
5. Grass hay	Post head	Dough to seed; stage in which seeds are of dough-like consistency until stage when plants are normally harvested for seed; more than 10 weeks' growth#	20 percent or more leaves**; brown to green; less than 20 percent foreign material; slightly musty odor, dust, etc.	<8	>41	>65	<83

6. Sample Grade
Hay which contains more than a trace of injurious foreign material (toxic or noxious weeds and hardware) or that definitely has objectionable odor or is under cured, heat damaged, hot, wet, musty, moldy, caked, badly broken, badly weathered or stained, overripe, dusty, which is distinctly low quality or contains more than 20 percent foreign material or more than 20 percent moisture.

* Chemical analyses expressed on dry matter basis. Chemical concentrations based on research data from NC and NE States and Florida. Dry Matter (moisture) Concentration can affect market quality. Suggested moisture levels are: Grade 2 < 14 percent, Grade 3 < 18 percent, and Grades 4 and 5 < 20 percent.
† Fertilization with nitrogen may increase CP concentration in each grade by up to 40 percent.
‡ Tropical grasses may have higher NDF concentrations than indicated in this table.
** Proportion by weight.
\# For grasses that do not flower or for which flowering is indeterminant.

SOURCE: Rohweder and Baylor. Forage and Grassland Progress. Vol. XX, Winter 1980. pp. 2-4.

is equally so. Hasbargen and I suggest forages be priced based on their relatve feed value. Table 7 lists examples of forages available in Minnesota with a suggested maximum pay price. Three different prices are listed on an as-fed basis (divide the price by the respective percent DM to obtain a price on DM basis). We use the current price of corn (energy component) and soybean meal (SDM - protein component) to establish a value for the energy and protein in each forage. The column identified protein and energy uses both values and the other two columns use energy and protein values separately. Use the protein and energy column to assess the value of forages to be used by the milking doe because it needs both energy and protein. However, a dry pregnant doe only needs a maintenance ration; use the energy only column.

Table 7. Laid-in-the-manger feed value relative to corn at $2.50/bu and SBM at $11.50/cwt.

Feed	Unit	DM %	TDN %	Crude protein %	$/unit Valued on energy & protein	$/unit Valued on energy	$/unit Valued on protein
		As fed basis					
Corn grain #2	bu	86.0	81.0	8.9	2.50	2.50	1.25
Barley	bu	89.4	77.7	12.1	2.39	2.06	1.45
Corn silage	ton	32.0	22.0	2.6	24.96	24.25	13.00
Sunflower silage	ton	22.6	12.2	2.1	16.41	13.45	10.50
Oat silage, dough	ton	30.0	16.0	2.7	21.31	17.64	13.50
Oatstraw	ton	89.7	44.9	3.6	45.47	49.49	19.50
Reed canary, mature	ton	91.0	45.5	10.0	69.64	50.15	50.00
Slough grass, mature	ton	90.0	40.8	5.8	50.11	44.97	29.00
Sorghum-sud hay, ave	ton	89.0	56.0	8.0	68.93	61.73	40.00
Sorghum-sud hay, early	ton	88.0	61.3	15.0	99.77	67.57	75.00
Soybean hay	ton	89.0	46.3	14.2	86.55	51.04	71.00
Alfalfa hay #2	ton	88.0	51.0	16.2	97.51	56.22	81.00
Alfalfa hay #3	ton	88.0	46.6	12.3	79.34	51.37	61.50
Alfalfa hay #4	ton	88.0	38.7	10.5	67.00	42.66	52.50
Grass hay #3	ton	88.0	51.0	13.2	85.82	56.22	66.00
Grass hay #4	ton	88.0	46.6	8.8	65.71	51.37	44.00
Grass hay #5	ton	88.0	38.7	5.3	46.74	42.66	26.50

SOURCE: Hasbargen and Martin. Minnesota Forage UPDATE. Vol. V. Summer 1980. p. 3.

THESE VALUES ARE MAXIMUM PRICES. If a forage will cost more than the suggested price, a better buy would be corn or SBM.

LITERATURE CITED

Hasbargen, Paul R. and Neal P. Martin. 1980. Forages valued on purchased energy and protein. Forage and Grassland UPDATE. V. Summer 1980. pp. 3.

Hutjens, Michael F. 1978. Feeding the dairy goat--challenges and opportunities. Proc. 1st Dairy Goat Conference. University of Minnesota, St. Paul, MN. pp.

Marten, G.C. and A.W. Hovin. 1980. Harvest schedule, persistance, yield and quality interactions among four perennial grasses. Agron. J. 72: 378-387.

Rohweder, Dwayne A. and John E. Baylor. 1980. New forage analyses offer new horizons for hay grading-marketing, evaluating forages. Forage and Grassland Progress. XX. Winter 1980. pp. 2-4.

Home Pasteurization

V. S. Packard
Extension Specialist, Dairy Porducts
University of Minnesota

Historical

The term pasteurization derives from the name of the scientist, Louis Pasteur, who first discovered and used the process as a way of preserving wine. Note that the process originally served a preserving function. Not until later was it to take on its present definition, which is really quite different from the original.

Today, pasteurization is a process--any process--by which a food product is rendered free of disease. While some preservative effect also occurs, pasteurization has its central function the destruction of those germs that cause human disease. In fact use of the process was first recommended in the U.S. in 1873 by a medical doctor (Abraham Jacobi) who was concerned about the risk of feeding raw milk to infants. And the important fact to note is that infant disease was dramatically reduced by feeding pasteurized milk. By 1908, public health authorities in Chicago had made pasteurization a requirement of all commercial milk. This was the first American city to do so. The requirement has since become law in all 50 states, although California yet carries a certified raw milk program. Even so, and even under the most rigorous sanitation standards, certified raw milk in California has been implicated in salmonellosis food poisoning outbreaks. No raw milk can nor should be considered free of disease, and even though it is produced under the most rigorous sanitary control.

Spread of Milkborne Disease

Raw milk can serve to spread disease in two different ways. First, certain diseases of the animal itself cause human disease. These animal diseases can be transmitted to humans with raw milk serving as carrier. Secondly, human diseases

can be spread through contamination of milk with human disease agents.

Animal Diseases that Can be Spread to Humans

A) Brucellosis (bang's disease) -- causes indulent fever. In goats the causative germ (bacterium) is Brucella melitensis.

B) Tuberculosis (animal type) -- causes human TB.

C) Q-fever -- an animal disease (cow, goat, sheep) caused by a Rickettsia (Coxiella burnetii).

D) Mastitis diseases -- a number of germs that cause mastitis (infected udders) may cause food-poisoning in humans. These include Staphylococcus aureus, certain coliform, streptococci, pasteurella, and Listeria monocytogenes.

E) Yersiniosis -- a disease in which symptoms are similar to appendicitis; caused by Yersinia enterocolitica.

F) Campylobacter fetus disease -- a disease that causes abortions in animals and severe flu-like symptoms in humans.

G) Viral diseases -- Both adenoviruses and tickborne encephalitis may be transmitted to humans through milk of animals carrying the diseases. Both can perhaps be considered rare diseases in the U.S. In other parts of the world, encephalitis is a common problem, and milk (goat, cows, sheep) is known to serve as a carrier.

H) Listeriosis -- caused by Listeria monocytogenes; causes mastitis and abortion in cattle; grows well in raw milk; milkborne disease reported by a number of workers.

Human Diseases that Can be Spread through Milk

A) Typhoid and Paratyphoid Fever-- caused by Salmonella typhosa, Salmonella paratyphi, and Salmonella schottmuelleri. Milk must be contaminated with fecal matter of infected human or rodent.

B) Scarlet Fever -- caused by Streptococcus pyogenes.

C) Septic Sore Throat -- caused by Streptococcus pyogenes. (This germ also causes septicemia and absecesses).

D) Diphtheria -- caused by Corynebacterium diphtheriae.

E) Human Tuberculosis -- caused by contamination of milk with human TB germ.

F) Poliomyelitis -- caused by a virus; transmitted through fecal matter.

G) Salmonellosis (salmonella food poisoning) -- caused by various strains of salmonella. Transmitted through fecal contamination of milk. Carried by poultry, wild birds, cattle and other animals, rodents, insects, humans, and domestic pets. Most often a post-pasteurization problem on various dairy products.

H) Staphylococcal food poisoning -- caused by certain strains of Staphylococcus aureus; transmitted through fecal contamination of milk; organisms secretes a toxin (poison) that is not destroyed by pasteurization; not often a raw milk problem because other bacteria compete favorably against S. aureus; more often a post-pasteurization problem in various dairy products.

I) Bacillus cereus food poisoning -- produces an enterotoxin similiar to S. aureus; found in soil and air; first recognized outbreak of milkborne poisoning in a number of children in 1972.

J) Clostridium perfringens food poisoning -- organism has been isolated from air, dust, soil, water, vegetables, fresh meat, intestinal tract of warm-blooded animals, seafood etc.; spores are resistant to drying conditions that otherwise would kill the vegetative cells; causes human food poisoning and gas gangrene, diarrhea and fever; produces an enterotoxin.

K) Enteropathogenic E. coli infections -- organism found only in intestinal tract of warm-blooded animals; commonly involved in infant diarrhea; has been found both in mastitic milk and milk from healthy cows; outbreak of food poisoning from imported french camembert and brie cheese has been reported, as well as outbreak among children consuming milk.

L) Shigellosis -- caused by shigella bacteria; milkborne outbreak reported in 1954.

M) Virus infections -- caused or thought to be caused by several viruses: adenovirus (possible cause of intestinal disease), enteroviruses (polio coxsackie, echo, and viruses that cause infant diarrhea), hepatitis virus (shed in feces).

N) Protozoan infections (toxoplasmosis) -- caused by Toxoplasma, a parasite widely distributed in nature; causes rash, high fever, chills; is perhaps more commonly a disease of animals that can be spread to humans.

Control Methods

1. Keep animals in clean, sanitary environment; control mastitis through sanitation and good milking practices.
2. Sanitize udders prior to milking.
3. Use strip cups, mastitis tests, and/or veterinary service.
4. Keep all milk handling equipment clean and sanitary.
5. Keep milk cold, preferably 36-40°F.
6. Pasteurize all milk, and prevent post-pasteurization contamination.

Definitions

To avoid confusion, please note the following definitions:

1. Pasteurization: any process by which milk or other food is rendered free of disease.
2. Sterilization: any process by which food is rendered free of all microbes including those that cause disease or spoilage.
3. Ultra High Temperature (UHT) Milk: milk that has been sterilized at temperatures ranging from 135-150°C (275-302°F). Requires no refrigeration for storage.
4. Ultra-Pasteurized Milk: by FDA definition, milk that has been thermally processed at temperatures at or above 138°C (280°F) for at least 2 seconds. FDA requires that it be refrigerated.

Regulatory Code

Recommendations regarding handling and processing of market milk products are to be found in the Grade A Pasteurized Milk Ordinance, 1978 revision. Most states adopt this Code verbatim as the regulatory statute. This Code relates both to cow milk and goat milk. The same overall recommendations apply equally for production, handling and stroage, and pasteurization of milk for home use.

Pasteurization Time and Temperature

Pasteurization requires that every particle of milk be heated to a specified temperature for a specified length of time. As the temperature goes up, the holding time is shortened. In commercial operations, pasteurizing equipment is sufficiently precise to allow several different time/temperature treatments. The Grade A Pasteurized Milk Ordinance lists the following.

Temperature	Time
145°F (63°C)	30 minutes
161°F (72°C)	15 seconds
191°F (89°C)	1 second
194°F (90°C)	0.5 second
201°F (94°C)	0.1 second
204°F (96°C)	0.05 second
212°F (100°C)	0.01 second

The first two and the last time/temperature treatments listed are the ones that have significance in home pasteurization. In every case, the time/temperature relationship shown is minimal! The temperature and time cannot drop below the figures given. To achieve minimal treatment requires equipment with very precise controls.

More practical time/temperature treatment of milk for home pasteurization becomes:

150-155°F -- 30 minutes
165-170°F -- 30 seconds
212°F (bring to a boil) -- flash treatment

Pasteurization of Cream or Products with Added Sugar

Cream and ice cream mix are both products that are thicker (more viscous) than milk. To properly pasteurize these products, it is necessary to increase the pasteurization temperature by 5°F (3°C). Minimal treatment becomes 150°F/30 minutes, or 166°F (15 seconds). For home pasteurization, the practical

application becomes:

155-160°F/ 30 minutes
170-175°F/ 30 seconds

Pasteurization of Eggnog

Eggnog, an extra rich, viscous product requires a more severe pasteurization treatment than other milk products. Minimal processing is given as 155°F/30 minutes, 175°F/25 seconds, or 180°F/15 seconds. Practical home treatment becomes:

160-165°F/30 minutes
180-185°F/25 seconds

Equipment for Pasteurization

Small home pasteurizers are offered for sale by Sears and Montgomery-Wards. These units come equipped with temperature adjustment controls, timing device, and automatic temperature control. Because temperature control is not too precise, higher than minimal pasteurization temperatures must be used. Temperatures cited above will suffice. These pasteuizers come in 5-quart and 2-gallon sizes.

Pasteurization can also be accomplished by heating milk in a double boiler. Use of a double boiler rather than direct heating in a pan will avoid scorching or burn-on which produces off-flavors in milk. The only other equipment necessary is a reasonably accurate thermometer. Because of the risk of breakage, a metal-bulb, dial-type thermometer is preferred. These are available through Weston Instruments Division, Newark, NJ 07114. These thermometers are accurate to within about ± 1°F. Other local thermometer suppliers are listed in the yellow pages of the telephone directory.

How to Pasteurize

On department store models of home pasturizers, follow manufacturers directions. You might also wish to check with your own thermometer the accuracy of the temperature setting. During pasteurization, agitation of the milk is

desireable. Some home units come with a built-in agitator. If a spoon or other type utensil is used for agitation purposes, the utensil should be left in the milk at all times. Otherwise you may re-contaminate the milk with a soiled utensil.

Following is the procedure for pasteurizing milk in a double boiler:

1. Add water to the bottom section, milk to the top.
2. Place lid on the top.
3. Heat to 165-170°F. Test temperature with clean, sanitized thermometer.
4. Hold temperature at 165°F or higher for about 30 seconds.
5. Cool milk quickly i.e. immerse milk-section of double boiler in cold tap water or ice water. Quick cooling prevents growth of spoilage bacteria which may have survived the heat treatment.
6. If another container is used for storing milk, that container must be thoroughly cleaned and sanitized. Wash it in hot sudsy water. Sanitize by rinsing in boiling water. Glass jars and lids serve this purpose nicely. Be sure lid is also cleaned and sanitized and is kept on the jar at all times. Be careful not to touch either the inside of the jar or lid with fingers. Re-contamination of milk is readily possible, and humans are the major source of disease contaminants.
7. Store milk under refrigeration at all times. Best storage temperature is 40°F or lower. At this temperature, milk should readily keep for 10-14 days, assuming no major re-contamination following pasteurization.

Pasteurization and Nutritive Value of Milk

Neither pasteurization at low temperatures for 30 minutes nor high-temperature, short-time pasteurization lowers significantly any major nutrient of milk. There is about a 10 percent loss in vitamin C, thiamine (vitamin B_1),

and vitamin B_{12}. Cow and goat milk are not considered good sources of the former two vitamins, and loss of 10 percent of vitamin B_{12} is not a significant reduction in nutritional value. Neither vitamin A nor vitamin D are influenced by the two above pasteurization processes.

HAVE YOU TRIED SAUSAGE?

by Thomas E. Hicks

My, but it's fun raising dairy goats. All that fresh milk, butter, cottage cheese, hard cheese, yogurt, ice cream...wow! I could go on and on.

It's sure a pleasure going out to milk and talking to all the girls. Occasionally the conversation gets around to kidding time and how many kids their holding this year.

"I have two," says Flossie. Good old dependable Flossie. Two every year for the past three years.

"I have three," says Peppermint.

"That's nice, Peppermint, maybe you will this year."

"I'm afraid one is all you'll get from me this year," Mable says disgruntedly. "But at least it will be big and healthy."

"That's fine, Mable. You always do give strong healthy kids."

"Well, Nina," I ask, "what about you?" Nina, the boss of the herd, was back in the hay manger, slowly chewing her cud. She was listening with only mild interest to my conversation with the others. When I mentioned her name she raised her head and asked me to repeat my question. "How many kids are you going to have this year, Nina?"

"Oh..." she said rather slowly, "four I guess."

"Four??"

"Four??!?"

"Four??!!!"

"Four??!!##**+=##!?" (Peppermint always was a little envious.)

"Yes, four!" Nina said emphatically. "All bucks!"

There was a long period of silence as we all grasped the magnitude of her four buck proclamation. "Four bucks," I thought to myself. What in the world will I ever do with all those bucks? They don't give milk, you only need one for breeding, a wether might be nice to keep the breeding buck company--but four? Then the thought struck me: Sausage!

The word rolled out of my mouth as an easy whisper, and I glanced quickly around to see if any of them heard me say it. I felt like I had just sworn out loud in church, as fleeting childhood fears of eating Bambi shot through my mind like gamma-ray bullets. I used that moment of stillness to bid the girls good-night, then raced into the house to rest in front of my fireplace, trying to calm my frayed thoughts as I pondered the fearsome future.

Most of us who raise dairy goats are faced with this inevitable problem of what to do with excess kids, especially the buck kids. There are many alternatives of course, and it's up to the individual to decide, with their family, which method of disposal is best for them. Families should take a good look at why they are raising goats in the first place, and how they feel about the various alternatives of disposal.

Some people feel it is best to kill the kid immediately after birth, either by a sharp blow with a hammer, or by shooting. This method lessens the chance for attachment by either the mother goat or the human family. It will yield more milk for raising does or for family consumption, and it will cut down future feed and hay costs. It also seems to be the hardest method for most people to do. The doe worked for five months to produce the kid, it is very cute and it's so helpless.... Well, anyway, I've never been able to do it.

Some breeders have found they can sell their castrated bucks as pets or "brush-eaters". This method works well until the market is saturated.

A third and somewhat more lucrative method is to locate a kid market which will buy the excess kids at so much per pound. It's a good way but not always convenient time or distance-wise and not always consistant from year to year. Then too, you are never sure what kind of price you are going to get.

The next method has two variations depending on your own philosophy, strength and desires. It entails raising your excess kids specifically for meat for your family.

The first variation is probably the simplest, and that is to ship the animal to a local butchering shop, order the cuts you want, then go back a week later to pick up the nice neatly wrapped white packages, each one stamped with the contents.

The second variation of raising the animal for your own meat is by far the most difficult. It can be a very emotional experience for you and your family, and you should spend much time talking about the effects, philosophically and ethically, so that everyone knows what to expect. Although you may never really be prepared for that final ultimate moment when you decide between a live goat and a dead goat, a certain amount of soul-searching is always helpful to the outcome.

Once you have made the decision to butcher, go with it. Do it with firmness and strength. Read the how-to books. Watch and help your neighbors and friends do theirs. Invite someone who is experienced at the task to help you. Dive into it with as much confidence as you can muster. You and your family will appreciate it, and you owe that at least to the animal itself.

Nearly every book on raising your own animals has a chapter on butchering. Other than the size consideration, the guidelines are very similar whether butchering Angora Rabbits or Angus Bulls.

The first of these is cleanliness. The cleaner the entire operation is, the cleaner and more nutritious the meat will be. There is nothing more embarrassing than inviting your city friends up to the farm for a delicious meal of chevon, and finding sand in the hot-dish.

If you can, avoid butchering in the goat barn, especially in view of the other goats. It doesn't seem right to do the deed directly in front of the others. If the weather is cooperating (cool, but not freezing), outdoors under a strong 12 foot high tree limb would work just fine.

The second guideline is to have the proper tools. Make sure they are handy and plenty sharp. Your serrated steak-knife might work well on a medium rare T-bone, but leave it in the kitchen drawer when you are doing the butchering. The minimum tools you will need are a round nosed knife for skinning, a butcher knife, and a crosscut saw. Other tools which would make the job easier are a boning knife with a 6"-8" blade, a meat saw, a hatchet or cleaver, a steel (to keep things sharp), and a carpenters razor knife.

I am familiar with three ways of killing the animal: 1. cutting the throat live and letting it bleed to death (said to give a better bleed and better meat), 2. stunning with a hammer then cutting the throat, and 3. stunning with a bullit then cutting the throat. Of these three methods I prefer the last one, as the gun seems to put some psychological distance between me and the act.

From this point on (with the exception of using nitrites and nitrates in the sausage), I and the books pretty much agree with the methods for skinning, hanging, making cuts and finishing up the whole process.

Therefore, I'm going to leave you with the bibliography. These sources present a good description of butchering your own meat as pictures and illustrations accompany the explanations.

When all is said and done and you are ready to savor your first taste of chevon, obtain a copy of Caprine Cookery, available for $3.50 P.Pd. from Goat Gifts Galore, Box 284, Clearwater, MN 55320. It is an excellent source of all kinds of caprine dishes, from succulent chevon to a myriad of milk by-products.

BIBLIOGRAPHY

1. Morton Salt Company, A Complete Guide To Home Meat Curing, Morton Salt Company, 110 North Wacker Drive, Chicago, Ill., 60606. (pg. 32-36)

2. Vivian, John, The Manual Of Practical Homesteading, Rodale Press, Emmaus, Pa., 1975. (pg. 282-294)

3. Bradbury, Margaret, The Shepherd's Guidebook, Rodale Press, Emmaus, Pa., 1977. (pg. 195-205)

4. Belanger, Jerome D., Raising the Homestead Hog, Rodale Press, Emmaus, Pa., 1977. (pg. 149-162)

5. Belanger, Jerome D., The Homesteader's Handbook to Raising Small Livestock, Rodale Press, Emmaus, Pa., 1974. (pg. 155-159 & 174)

6. Kanable, Ann, Raising Rabbits, Rodale Press, Emmaus, Pa., 1977. (pg. 155-163)

7. Luisi, Billie, A Practical Guide to Small-Scale Goatkeeping, Rodale Press, Emmaus, Pa., 1979. (pg. 156-159)

SOURCES OF INFORMATION ON DAIRY GOATS

By: R.D. Appleman, Extension Dairyman, University of Minnesota

LEAFLETS, CIRCULARS, AND BULLETINS

A. Dairy Goat Management and Production

1. Dairy Goat Production Guide, NE-2
   L. R. Brown, Department of Animal Industries, University of Connecticut,Storrs, Connecticut 06268; and B. Harris and R. L. Richter, Dairy Science Department, Gainesville, Florida 32611 (1975) -- 18 pages.

2. "Dairy Goat Management"
   G. F. W. Haenlein, Department of Animal Science and Agricultural Biochemistry, University of Delaware, Newark, Delaware 19711, Journal of Dairy Science, Vol. 61, No. 7, (July 1978) --1011-1022.

3. The Dairy Goat, Information Bulletin 78
   W. F. Brannon, Animal Science Department, Cornell University, Ithaca, New York 14853 (1975) -- 12 pages.

4. Dairy Goats: An Introduction to Management
   W. A. Gross and R. I. Millar, Animal Science Department,University of Rhode Island, Kingston, Rhode Island 02881, mimeo (1978) -- 13 pages.

5. Dairy Goat Care and Management
   A. M. Meekma and Jack L. Groff, Department of Animal Science, Texas A & M University, College Station, Texas 77843 (1975) -- 8 pages.

6. Dairy Goats - Breeding, Feeding, Management
   B. E. Colby, D. A. Evans, S. L. Lyford, W. B. Nutting, and D. W. Stearn. University of Massachusetts. Available from American Dairy Goat Association, Box 186, Spindale, N.C. 28160 -- 78 pages.

B. Dairy Goat Genetics

1. Own a Dairy Goat
   The American Dairy Goat Association, P. O. Box 865, Spindale, North Carolina 28160 -- 8 pages.

2. "Genetics of Dairy Goats: A Review"
   M. U. Iloeje and L. D. VanVleck, Animal Science Department, Cornell University, Ithaca, New York 14853, Journal of Dairy Science, Vol. 61, No. 8 (1978) -- pages 1521-1528.

3. Breeds of Dairy Goats, Guide 400, D-702
   Borden Ells, Department of Animal and Range Sciences, New Mexico State University, Las Cruces, New Mexico 88003, (revised 1975) -- 3 pages.

C. Dairy Goat Reproduction & Breeding

1. The Artificial Insemination of Dairy Goats
H. A. Herman, American Supply House, Box 1114, Columbia, Missouri 65201 (1972) -- 24 pages.

2. "Reproduction and Breeding of Goats"
Maurice Shelton, Texas A & M University, Texas Agricultural Experiment Station, San Angelo, Texas 76901. Journal of Dairy Science, Vol. 61, No. 7, (1978) --pages 994-1010.

3. Management of Reproduction in Sheep and Goat Symposium
Sheep Industry Development Program, American Society of Animal Science and American Association of Sheep and Goat Practitioners, Chairman Clair E. Terrill, National Program Staff, Agricultural Research, Science and Education Administration, USDA (1977) --149 pages.

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"
G. F. W. Haenlein, Hoard's Dairyman, October 10, 1978 -- 2 pages.

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, Southhampton 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, Massachusets 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.

4. Goat Gifts Galore (Thomas E. Hicks)
   P.O. Box 284, Clearwater, MN 55320 (612/558-2280)