

AGRICULTURAL ALTERNATIVES

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Dairy Goat Production

Dairy goat production is an alternative livestock enterprise suitable for many small-scale or part-time livestock operations. Some dairy goat producers have been successful in pasteurizing goat milk and building an on-farm jugging business, while others have ventured into processed milk products for retail distribution, especially specialty cheeses and yogurt. The potential also exists for selling milk to processors, usually on a regional basis. Although fluid milk and processed products are important markets, dairy goat producers should also consider the potential for selling animals to hobbyists and youth involved in vocational agriculture livestock projects.

In much of the developing world, goat milk is the primary milk source for humans. Goat milk is often sought for its perceived health benefits and unique taste. Although a number of health effects have been attributed to consuming goat milk, scientific evidence does not support most health claims. Goat milk is similar in composition to cow milk (Table 1), but some important differences exist in the protein structure. Because of these differences, people who have allergies to cow milk can often drink goat milk, and the fat globules in goat's milk stay in suspension longer, which leads to the perception of "natural homogenization." Goats are good browsers and allowing them to consume plants containing aromatic or flavor compounds can impart the smell or flavor to the milk or cheese, thus providing an opportunity to generate unique specialty products.

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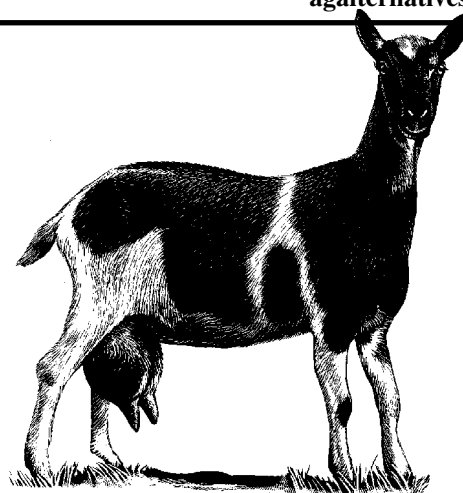


Table 1. Comparison of average milk composition.

NUTRIENT	HUMAN	COW	GOAT
Energy (kcal/100 ml)	68.00	69.00	70.00
Lactose (%)	7.30	4.70	4.10
Protein (%)	1.10	3.50	3.20
Fat (%)	4.00	3.60	3.80
Cholesterol (mg/100 ml)	20.00	15.00	12.00
Ash (%)	0.20	0.70	0.80
Calcium (%)	0.04	0.18	0.19
Phosphorus (%)	0.06	0.23	0.27
Iron (%)	0.20	0.06	0.07
Vitamin A (IU/g fat)	32.00	21.00	39.00
Vitamin D (IU/g fat)	0.30	0.70	0.70
Vitamin C (mg/100 ml)	3.00	2.00	2.00
Thiamin (µg/100 ml)	17.00	45.00	68.00
Riboflavin (µg/100 ml)	26.00	159.00	210.00

Data from <http://www.ADGA.org/>

Abbreviations: kcal/100 ml is a measure of energy content, 1 kcal = 1,000 calories; IU = international unit, a measure of vitamin potency; µg = microgram, 1/1000 milligram

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Marketing

The main marketing issue for prospective dairy goat producers is the number of commercial processors to whom raw milk can be shipped. It is against the law in most states, including Pennsylvania, to sell raw milk unless it is inspected by state milk inspectors. An alternative use for goat milk is as an on-farm substitute for milk replacer in lamb, veal, and pig diets. To use goat milk as an alternative feed source requires that the dairy goat producer buy and market lambs, veal calves, or piglets. This means additional management and marketing skills are necessary, but it does allow the use of goat milk without state inspection.

Dairy goat producers must also realize that income from the kid goat crop is important. In addition to marketing fluid milk or using it as an on-farm milk replacer, the producer must have a kid goat marketing strategy. It may be beneficial to raise kid goats to different market weights and for different market seasons. Many ethnic groups are interested in purchasing kid goats, but producers must be aware of the desired weights and times when demand is greatest in such markets (see <http://www.sheepgoatmarketing.org/sgm/education/ethnicholidays.htm>). For more information on raising meat goats, see *Agricultural Alternatives: Meat Goat Production*.

Production

The six major dairy goat breeds are the Saanen, Nubian, Toggenburg, LaMancha, Oberhasli, and Alpine. The lactation period for dairy goats averages 284 days, with peak production usually occurring 4 to 6 weeks after kidding. Representative production data for the various goat dairy breeds can be found in Table 2. Volume and composition of milk produced is controlled by the goat's genetics but greatly influenced by the diet consumed.

Dairy goats reach sexual maturity at 4 to 5 months of age. Young does should be bred at a body weight ranging from 70 to 80 pounds, which usually is at an age of 7 to 10 months. The gestation period ranges from 145 to 155 days with an average length of 149 days. Does normally produce between one and three kids per year (single-born kids weigh approximately 6 to 6.5 pounds at birth). Birth weights generally decline with multiple births and are often associated with increased mortality. Quality of nutrition during pregnancy influences birth weight and kid survivability. Pregnancy nutrition becomes an important part of good management as twin births are desired in an effort to improve productive efficiency. Does giving birth to twins produce more milk and have greater total kid weight per maintenance doe unit. **Daily weight gains after birth range from 50 to 150 grams per day (0.1 to 0.33 pound per day), but meat goat crosses can exceed 250 grams per day (0.55 pound per day).** Rate of gain will be determined by diet and the end product desired (replacement doeing or various weights depending on the meat market).

To ensure efficiency and productivity of a dairy goat enterprise, the three most important recommendations are as follows:

1. Manage young does to have them ready for breeding at 7 months of age. This increases the total lifetime herd production of milk and meat and reduces the number of nonproducing animals in the herd at any one time.
2. Encourage freshening of the does over as wide a time span as possible. This provides the customers with a year-round source of milk.
3. Cull animals to eliminate low producers. This can increase the herd productivity if animals are culled for genetic reasons.

Table 2. Milk production by dairy goat breed (2003 DHIR data).

BREED	MILK PRODUCTION (LBS/LACTATION)		MILK FAT (%)	MILK PROTEIN (%)
	AVERAGE	RANGE		
Alpine	2,266	790–5,470	3.4	2.9
LaMancha	2,100	740–4,320	4.0	3.2
Nubian	1,820	560–4,270	4.9	3.7
Oberhasli	2,146	930–4,450	3.9	2.9
Saanen	2,577	610–5,490	3.3	2.9
Toggenburg	2,115	940–4,380	3.2	2.7

Note: Individual doe data not adjusted for age (275- to 305-day records)

Nutrition

To maintain milk production and good health, goats should be fed a diet balanced for energy, protein, minerals, and vitamins based on requirements defined by the National Research Council. To reduce costs, forages such as hay, silage, and pasture should constitute a majority of the daily diet. Goats are efficient browsers and can select a high-quality diet from lower-quality forages, especially when consuming nontraditional pasture plants (e.g., weeds, shrubs). Available forages should be evaluated based on plant species and maturity, with the highest-quality forages reserved for pregnant, lactating, and growing animals.

Supplementing the diet with grain mixes to provide additional energy and protein is important, especially during lactation. Grain mixes may also contain supplemental minerals and vitamins. Feeding grain should be limited because a high-grain diet with low fiber intake can lead to rumen health problems (e.g., indigestion, acidosis) and lower milk fat content. Availability of dietary energy is important for high milk yield, while protein and fiber affect milk quality. High-producing does require quality forages and supplemental grain at a rate of 1 pound per 2.5 to 3 pounds of milk.

Forages generally do not contain sufficient minerals to meet dietary requirements, so supplements are usually required. Mineral mixes of salt with calcium, phosphorus, and trace minerals are typically used. Legume forages (e.g., alfalfa, clover) contain sufficient calcium and will only require phosphorus with trace mineral supplement.

If pasture is the predominant source of forage, then vitamin supplements are not critical. If only hay or silage is used, then supplemental vitamin A, D, and E will be required. Vitamins can be supplied in a free choice mineral source or in the grain mix. Commercial cow rations or custom grain mixes varying from 14 to 20 percent protein can be fed to goats (Table 3). Most products formulated for sheep will not contain enough copper for goats.

It is important to routinely use a technique called “body condition scoring” to evaluate the adequacy of the nutritional program you use. Body condition scoring categorizes animals in scores from 1 (emaciated) to 5 (obese) based on the amount of palpable subcutaneous fat over the loin, ribs, and sternum. Does should have adequate (score 3) body reserves in late pregnancy as they enter lactation. High-producing does lose significant body condition during early lactation but should regain it again during late lactation and early pregnancy. Details on body condition scoring can be found on the Langston University Web site (see reference listing for Web address).

Table 3. Example grain mixes with varying protein content for goats.

INGREDIENT	CONCENTRATE PROTEIN CONTENT (% OF MIX)			
	14.0	16.0	18.0	20.0
% OF TOTAL				
Cracked or rolled corn	40.0	35.0	29.0	24.0
Rolled oats	20.0	20.0	20.0	20.0
Soybean meal (44 percent)	17.0	22.0	28.0	33.0
Beet or citrus pulp	10.0	10.0	10.0	10.0
Molasses	10.0	10.0	10.0	10.0
Trace mineral salt ¹	1.0	1.0	1.0	1.0
Limestone ²	1.0	1.0	1.0	1.0
Dicalcium phosphate ²	0.7	0.7	0.7	0.7
Magnesium oxide	0.2	0.2	0.2	0.2
Vitamin premix ³	0.1	0.1	0.1	0.1

1. Must contain adequate selenium in deficient areas
2. Amounts can be varied to adjust to legume or grass forages
3. Should provide 1,000 IU/lb vitamin A, 500 IU/lb vitamin D, and 5 IU/lb vitamin E

Herd Health and Biosecurity

Goats, for the most part, are a hardy species that requires minimal, basic necessities to survive and produce a quality product. Most herd problems relate to nutrition and reproduction, but a number of diseases are of concern. Some goat diseases can also infect people, so handlers must be aware. Services of a veterinarian should be sought to develop an appropriate herd health program.

Parasites, both internal and external, are the most important health concern for goat health and productivity. Weight loss, rough hair coat, and diarrhea are common signs of parasitism. Anemia (pale mucous membranes) due to internal parasites can also be an indicator of problems. A veterinarian or trained herdsman can determine if internal parasites are present by examining a fresh fecal sample. An increasing problem with parasite control in goats is parasite resistance to dewormers. Repeated use of dewormers without other parasite-control management is increasing resistance problems. Below are other parasite control measures:

- Treat only sick animals.
- Practice proper sanitation such as keeping feeders and waterers free from feces and bedding.
- Avoid overcrowding.
- Practice good pasture management.
- Isolate sick animals.
- Isolate new animals for 30 days before incorporating them into the herd.

Because of year-round parasite problems, goats from the southeastern United States often harbor dewormer-resistant internal parasites. You will need to address this biosecurity issue if you plan on purchasing animals from this area.

Important infectious diseases of goats include caseous lymphadenitis (CL), caprine arthritis-encephalitis (CAE) virus, *Mycobacterium avium* spp. paratuberculosis (Johne's disease), and contagious ecthyma (orf, sore mouth). All these diseases are best controlled by practicing good biosecurity since they are readily passed by animal contact or through milk from an infected doe. There is essentially no treatment for these diseases and vaccines are available only for CL and sore mouth. It is recommended that you only vaccinate for sore mouth if there has been a history of the disease on your farm or within the herd. Work with a veterinarian to establish good screening test protocols for purchasing animals and a basic farm biosecurity program to prevent disease spread.

Other health problems for goats include footrot, abortion, and mastitis. Footrot is typically a bacterial infection of the skin between the claws. Footrot control starts with biosecurity to prevent infected animals from being brought onto the farm. It can also be reduced by good preventive care including routine hoof trimming. Nutrition as well as infectious agents can cause abortion in goats.

Toxoplasmosis, transmitted by younger cats, can cause abortion in both women and goats. Prevention requires keeping cat feces from contaminating feed consumed by pregnant goats.

Mastitis, an infection of the udder, is a major concern with dairy goats. Providing sanitary conditions, good milking procedures, well-ventilated housing, and dry bedding are the best defenses against this disease. Injuries to udders and teat ends also contribute to this disease, which can lower milk production and cause permanent damage to does.

Housing and Equipment

There are four requirements for efficient dairy goat housing. First, the building should be adequately ventilated and the walls and ceiling should be free from condensation. Second, the bedded area should be dry and clean. Third, feeders and watering devices must be well built and located so that feed and water are not contaminated with animal wastes or inefficiently wasted. Ready access to good-quality water is essential for milk production and herd health. Fourth, housing should be arranged to minimize the amount of labor and time required for maintaining a clean facility.

A number of housing systems can be successfully used for goat production. In the northeast United States, either loose (manure pack) or confinement (individual stalls) housing systems, with or without pasture access, are necessary to provide sufficient protection from adverse weather. Building adequate fencing to keep the goats contained can be a real challenge. The best fencing for goats is electrified woven wire or livestock panels at least 48 inches high.

The milking area should be separated from the stable area and have a concrete floor to make cleaning easy. The milking platform should be 15 to 18 inches higher than the floor to permit easy milking. Milk must be cooled immediately after milking and held at a temperature under 40°F until processed or consumed. Cooling is critical to retain milk flavor and quality. Bacteria in warm milk begin to multiply in a short period of time and cause the milk quality to deteriorate. Cold water is more efficient than cold air for cooling milk. The refrigerator or cooler for small herds should accommodate a pan of water equal to the amount of milk in one or more milking buckets. A herd producing 10 or more gallons per day will need a water-immersion cooler or a bulk tank cooler.

Risk Management

You may wish to consider several risk-management strategies for your operation. First, you should insure both your facilities and your animals. This may be accomplished by consulting your insurance agent or broker. Second, you may want to insure your income through a crop insurance program called AGR-Lite. To use AGR-Lite you must have five years of Internal Revenue Service (IRS) Schedule F forms. For more on agricultural business insurance, see *Agricultural Alternatives: Agricultural Business Insurance*. For more information concerning crop insurance, contact a crop insurance agent or check the Pennsylvania crop insurance education Web site at <http://cropins.aers.psu.edu/>.

Local Regulations

All agricultural operations in Pennsylvania, including small and part-time farming operations, operate under the Pennsylvania Clean Streams Law. A specific part of this law is the Nutrient Management Act (also known as Act 38), which may or may not pertain to your operation due to the number and/or size of animals you have. However, all operations may be a source of surface- or groundwater pollution. Because of this possibility, you should contact your local Soil and Water Conservation District to determine what regulations may pertain to your operation.

You should also check your local zoning regulations to make sure that your intended business activities are permitted in your location.

Sample Budgets

The sample budget in this publication is an example of costs and returns to a commercial milk goat production system for 100 does. This sample budget should help ensure that all costs and receipts are included in your calculations. Costs and returns are often difficult to estimate in budget preparation because they are numerous and variable. Therefore, you should think of these budgets as a first approximation and then make appropriate adjustments using the “Your Estimate” column to reflect your specific production situation.

Initial Resource Requirements

- Land: 10 acres
- Labor (per head): 15 hours x 100 does = 1,500 hours
- Capital:
 - Livestock (per head): $\$130 \times 100 \text{ does} = \$13,000$
 - Existing buildings, improvements, fencing: \$12,000
 - Milking equipment, storage: \$15,000
 - Total: \$40,000

Sample Dairy Goat Budget (per doe, per year)

Does averaging two kids. Fixed costs are based on a 100-doe facility (artificial insemination).

Item	Per Doe	Amount	Unit	Price	Total	Your Estimate
Receipts						
Milk sales*		21.7	cwt	\$26.00	\$564.20	_____
Does culled (5% death loss, 25% replacement rate)	0.25	120.0	pound	\$0.50	\$15.00	_____
Male kids sold (8% death loss)	0.92	30.0	pound	\$1.50	\$41.40	_____
Replacements sold (fertile, nonfertile)	0.67		head	\$130.00	\$87.10	_____
<i>Total receipts</i>					\$707.70	_____
Variable Costs						
Feed						
Concentrates for doe and replacement		10.0	cwt	\$20.00	\$200.00	_____
Concentrates for kids (sold for meat at 30 pounds)		0.4	cwt	16.00	\$6.40	_____
Hay (assuming pasture is available)		0.9	ton	\$120.00	\$108.00	_____
Milk fed to kid goats		0.8	cwt	\$26.00	\$20.80	_____
Total feed costs					\$335.20	_____
Other variable costs						
Building and equipment repairs				\$20.00	\$20.00	_____
Bedding (saw dust)				\$2.50	\$2.50	_____
Miscellaneous livestock supplies				\$10.00	\$10.00	_____
Breeding fees				\$15.00	\$15.00	_____
Health program				\$15.00	\$15.00	_____
Milk testing (DHIA)				\$22.00	\$22.00	_____
Utilities, gasoline, fuel, oil				\$20.00	\$20.00	_____
Milk hauling, freight		21.7	cwt	\$3.00	\$65.10	_____
Marketing, advertising, coop dues		21.7	cwt	\$0.10	\$2.17	_____
Total other variable costs					\$171.77	_____
Interest on operating capital					\$20.28	_____
<i>Total variable costs</i>					\$527.25	_____
Fixed Costs						
Family and hired labor		15.0	hour	\$10.00	\$150.00	_____
Insurance and taxes					\$20.00	_____
Milking equipment depreciation					\$15.00	_____
Building, other equipment depreciation					\$12.00	_____
Breeding livestock depreciation					\$28.75	_____
<i>Total fixed costs</i>					\$225.75	_____
Total costs					\$753.00	_____
Returns						
Returns over variable costs					\$180.45	_____
Net returns					\$(45.30)	_____
Breakeven price per cwt					\$28.09	_____

*Milk prices will vary based on location and availability to markets.

For More Information

Reference Books

Belanger, Jerry. *Raising Milk Goats the Modern Way*. North Adams, Mass.: Storey, 1990.

Carroll, Ricki and Robert. *Cheesemaking Made Easy*. North Adams, Mass.: Storey, 1995.

Dairy Reference Manual. Northeast Regional Agricultural Engineering Service Cooperative Extension. 1995. http://www.nraes.org/nra_order.taf?_function=detail&pr_id=37&_UserReference=E63941C395A3B7DB479A32BC

Dunn, Peter. *The Goatkeeper's Veterinary Book*. 3rd ed. Preston, England: Farming Press, 1998.

Matthews, John. *Diseases of the Goat*. 2nd ed. Malden, Mass.: Blackwell Science. <http://www.blackwellpublishing.com/book.asp?ref=9780632051670&site=1>

National Research Council Committee on Animal Nutrition. *Nutritional Requirements of Goats*. Washington, D.C.: National Academy Press, 1981. <http://www.nap.edu/catalog/30.html>

Pugh, David A. *Sheep and Goat Medicine*. Philadelphia: W. B. Saunders, 2002.

Smith, Mary C., and David M. Sherman. *Goat Medicine*. Malvern, Pa.: Lea & Febiger, 1994.

Web Sites

ATTRA, National Sustainable Agriculture Information Service: <http://attra.ncat.org/livestock.html>
Contains a number of very detailed papers and resource checklists about small ruminant and dairy goat production enterprises

University of Langston
E[Kika] de la Garza Institute for Goat Research:
<http://www.luresext.edu/goats/index.htm>
Contains information on calculating goat nutrition requirements and estimating body condition score

University of Maryland Small Ruminant Web Site:
<http://www.sheepandgoat.com/>
Contains a wide variety of information from many resources from around the world

Periodicals

Dairy Goat Journal
145 Industrial Drive
Medford, WI 54451
<http://www.dairygoatjournal.com/>

United Caprine News
P.O. Box 328
Crowley, Texas 76036
<http://www.unitedcaprinenews.com/index.html>

Registry Associations
American Dairy Goat Association
P.O. Box 865
Spindale, NC 28160
<http://www.ADGA.org/>

American Goat Society, Inc.
Rt. 1, Box 56
Esperanle, NY 12066
<http://www.americangoatsociety.com/>

International Dairy Goat Registry
Rt.1, Box 265
Maple Valley, WA 98038
<http://www.goat-idgr.com/>

Milking Goat and Sheep Equipment
Alfa-Laval Agri. Inc.
11100 N. Congress Avenue
Kansas City, MO 64153-1222

Arkansas Gold Products
P.O. Box 210
Lamar, AR 72846

Gascoigne Milking Equipment, Ltd.
Edison Road, Hound Mills
Basingstoke, Hampshire
United Kingdom RG21 2YJ

Fullwood & Bland Ltd.
Ellesmere, Shropshire
United Kingdom SY12 9DF
http://www.fullwood.com/milking_products/122/

Hastings Welding
1630 Vermillion Street
Hastings, MN 55033

The Schlueter Company
216 Center Street
P.O. Box 548
Janesville, WI 53547
<http://www.schlueterco.com/>

New England Cheesemaking Supply Co.
P.O. Box 85
Ashfield, MA 01330
<http://www.cheesemaking.com/default-cPath-24.php>

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