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Meat Goat Basics for Hawai'i

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Introduction

Demand for goat meat, called cabrito or chevon, far exceeds its supply, making it the world's most sought-after meat, and it is an important sector of the livestock industry in Hawai'i (Devendra and Burns 1983; Figure 1). In 2011, 410 million goats provided over 5.6 million tons of meat for consumers worldwide (FAO 2013). According to the USDA National Agricultural Statistics Service (2013), there are currently 2.32 million meat goats in the U.S. The country has been a net importer since 1991, bringing in more than 700,000 goat equivalents since, primarily from Australia (Geisler 2011). The USDA NASS (2013) further reports that Hawai'i's total goat inventory is at 12,000, a 56% increase over the 2012 inventory. Among the benefits of goat meat are easy digestibility, good taste, low fat and cholesterol, and small carcass size, which is important for regions and families with limited access to refrigeration (Correa 2011). Meat goats also provide valuable by-products, such as fiber, manure, and leather, and secondary uses, such as weed control, fire fuel reduction, and even drayage.

Goat meat is particularly popular among cultures from the Philippines, near and South Asia, Latin America, Africa, the Caribbean, and others. Individuals from these regions drive a strong demand for goats sold on the hoof for home slaughter in Hawai'i. Much of the demand peaks around religious holidays, graduations, weddings, and other celebrations.

The purpose of this publication is to provide general guidelines and considerations for those interested in or currently raising goats on a commercial scale or for pleasure, with particular attention to issues relevant to Hawai'i. Each section is worthy of an entire publication, and thus a list of resources at the end of this paper is intended to help direct those seeking more in-depth or technical information to reliable and helpful sources. An exceptional source for goat research and education is available for free at the E. (Kika) de la Garza American Institute for Goat Research at Langston University website: http://www.luresext.edu/goats/training/QAtoc.html. This website also deals with many other topics not covered in this publication.

Figure 1. Replacement doelings on Maui (photo courtesy of Haleakala Ranch).

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Breeds

Selecting animals from breeds with traits suited to production in the tropics will greatly reduce headaches down the line. While individuals from many breeds and crosses of breeds can potentially do well, four breeds stand out and have been well tested in Hawai'i: Kiko, Spanish Meat Goat, Boer, and Tennessee Meat Goat.

Kiko (Figure 2) – Producers in New Zealand crossed feral does with Nubian, Toggenburg, and Saanen bucks, eventually creating a closed herd of what they named Kiko goats, after the Maori word for meat (OSU 1997). A key characteristic of this breed is rapid growth under rugged conditions. Goats of this breed have been raised extensively on Maui and the Big Island with great success.

Spanish Meat Goat (Figure 3) – Though this is more a catchall term than a specific breed, goats so named have thrived in the Southwest U.S. through several centuries of natural selection (OSU 1996a). This is a rather small, hardy meat goat adapted to doing well on sparse and rugged rangeland. Feral goats in Hawai'i share characteristics with this type.

Boer (Figure 4) – A large and prolific cross originating in South Africa from Bantu feral goats, Dutch crosses, and Nubian goats, this is a horned, very meaty goat (OSU 1996b). Given a high plane of nutrition, Boer goats and Boer crosses commonly have a 200% kidding rate and can produce outstanding carcasses (Nye and Moore 2002). Some producers who have brought this goat from the mainland to Hawai'i report that Boer goats do better in a feeding system and are not as strong foragers as other breeds.

Tennessee Meat Goat – Also called a fainting goat or wooden leg, this myotonic goat will sometimes will fall over when startled. This goat breed was developed for large size and meat production. Breed proponents claim the frequent stiffening and relaxing of its muscles may result in heavier rear leg muscles, tender meat, and a high meat-to-bone ratio (OSU 1996c).

Goals

Any agricultural production system, whether pursued as a hobby or for profit, begins with a clear and explicit statement of goals. In making production goals, start with an end in mind: If you had 10 to 15 market-ready goats today, what would you like to do with them? What would you *need* to do with them? Specifically, to whom would you sell them? What is the market asking for? Can you meet this demand consistently in quantity and quality? Do you have adequate resources, or are you willing to get them? Are you willing to invest and do what it takes to meet this market? Figure 5 can help guide you through the goal-making process. For more on effective goal-setting, see "Goal Setting by Farm and Ranch Families" by Doye (1990), available at http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1674/F-244web.pdf.

Figure 2. Kiko goat on Maui.

Figure 3. Spanish meat goats on Maui.

Figure 4. Boer cross goat (Photo courtesy Haleakala Ranch).

Production Requirements

An effective meat goat production system will address the type of management system (extensive free range, intensive rotational grazing, or dry lot), water needs, reliable feed supply or pasture improvements, breeding calendar, marketing, animal health needs throughout the production year, labor requirements, protection from predators, and capital resources. This section will address these issues in the following broad categories: breeding cycle, animal health, and nutrition and pasture management. Adjustments to or fluctuations in any one of these areas affect each of the others in varying degrees. The issues that are priorities or require your focus will depend on your individual farm goals and your starting point.

Breeding

When to breed your does and how many breeding seasons to have depends largely on your market demand, the size of your herd, feed quality at kidding and rebreeding, labor availability, and in general your goals. As the primary market in Hawai'i is for live weaned kids, and because the climate is amenable to year-round production, most goat producers aim to have a consistent supply of marketable kids throughout the year.

Gestation in goats takes on average 155 days, or about 5 months. Market kids weigh from 40 to 90 lbs. at 4 to 6 months of age. The amount of time it takes to reach market weight is an interaction between breed or genetics, feed quality and quantity, herd health management (especially parasites), and weather.

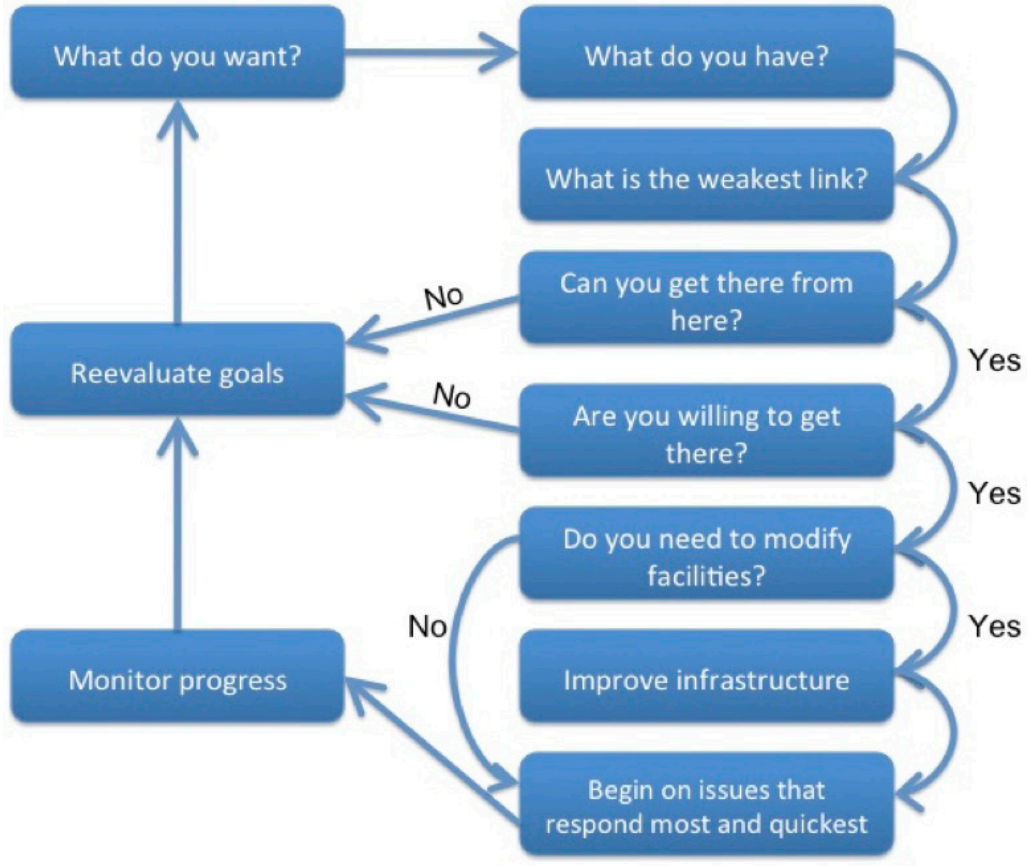

Figure 5. Goal-setting guide; start at top left.

Sample breeding year for an operation in Hawai'i.

October 30
- Group breeding does
- Increase high-quality feed for breeding bucks and does (called flushing)
- Introduce bucks to does; record breeding/exposure dates

December 30
- Remove bucks (expect two heat cycles over 42- to 62-day period)

Late February to March 30
- Increase quality of feed for bred does during last 6 weeks of gestation
- Prepare for kidding (housing, medicine/vaccines, etc.)

Early April
- Kidding begins
- Dip navels in iodine to prevent infection
- Make sure kids getting colostrum (first milk)
- Castrate
- Weigh kids at 30 days of age

May 30 to early June
- Wean kids
- Weigh and make breeder selections
- Reduce supplementation of does to hasten drying up and prepare for rebreeding

Four key elements influence how to select top breeders: 1) reproductive efficiency, 2) survivability, 3) growth rate, and 4) feed efficiency. Consistent recordkeeping is essential for evaluating does on these factors.

Reproductive efficiency is simply the number of live births a doe has over a period of time or per number of buck exposures. This is the most important factor related to profit. A mature doe should give birth to twins three times in two calendar years. Issues affecting reproductive efficiency are length of breeding season (a shorter season enables more breeding periods per year), ability to flush, health, and predator control.

Survivability refers to the percent of kids weaned from a doe out of the total births. The true value in a doe is in the number of kids she successfully weans as opposed to how many she gives birth to. A doe should wean at least two kids or more per year in good forage environments with good predator control. The most important stage in terms of kid mortality is from birth to weaning. Factors affecting kid mortality during this stage are birth weight (i.e., triplets often have one stunted kid), disease management (e.g., vaccinations and colostrum), mothering ability of the doe, and predator and parasite control.

Creating conditions that favor higher growth rates increases efficiency by moving market animals out of the system faster. In other words, your forage costs will be lower if you have quickly maturing kids, and more days of pasturage will be left for your does. Breed types, sex, and individual genetics are the main internal factors affecting growth rates. Castrated males tend to grow faster than females. Remember that while a single-birthed kid may grow faster than twins, the twins may produce more total pounds of meat per acre and more individuals for sale per year. Growth rate is thus less important than reproductive efficiency and survivability when making breeding selections. Also, select for growers that respond to your actual feed conditions as opposed to those that perform well only when on a high plane of nutrition. Environmental conditions such as adverse weather, parasites, and low feed quality can all reduce growth rate regardless of genetic potential.

The vast majority, if not all, of meat goat feeding systems in Hawai'i are accomplished with improved pasture or extensive range (Figure 6). The cost of imported feeds versus returns on goat sales generally prohibits dry lot systems. Furthermore, the high labor and fuel costs associated with cut-and-carry forage systems also tend to limit the payoff of this type of dry lot. Therefore, selecting for breeding animals that feed themselves well by foraging gives the best returns. Providing shelter from the elements will greatly improve feed efficiency.

In summary, select for the best females, ones who consistently give birth to twins (3 times in 2 years) and have a high rate of weaned kids (at least 2 per year), high growth rate of offspring on forage, and high weaning weights of kids. To improve your reproductive efficiency and bottom line, learn to be a ruthless culler. One Maui

producer asked other goat producers to come to make the cuts since he felt his own judgment was too biased. Cull open does (those that do not get pregnant after breeding) and old does. Old does with poor teeth will not be able to forage well enough to come into heat, will have fewer kids per birth, or will not be able to eat enough to provide adequate milk. Simply culling the bottom 10–20% of your does based on these factors will gradually shape your herd genetics toward good performers under your specific conditions. When using bucks from within your herd, select those whose mothers had these traits.

Usually a ratio of one buck to twenty does is adequate. Remember that the buck you use contributes one half of the individual offspring's genetics, and bucks at a 1:20 ratio account for 80% of the herd-level genetic composition. Unless you know a specific reason why a doe came open or only gave single births (e.g., severe weather or poor buck performance), give your replacement does no more than two chances before culling. Good identification methods and recordkeeping make these decisions possible.

Animal Health

The following section describes common health problems in meat-goat herds in Hawai'i. Many other health issues can also be a concern, and any omission here of particular issues is not meant to indicate that they may not be a problem. The following are general recommendations for information purposes. Always consult a veterinarian for specific diagnoses and treatments. In all treatments, follow label or veterinarian instructions, and be sure to note withdrawal times before sending goats to market. For example, a withdrawal time of 21 days means a goat cannot be slaughtered within 21 days of receiving a medication.

Figure 6. Despite being on drought-stricken range on Maui, this doe is pregnant and maintains full udders. Goats are an excellent animal for droughty areas or extensive production practices.

Clostridial diseases—tetanus and *Clostridium perfringens* C & D—are a leading cause of death in young kids. Clostridial bacteria are widespread in the environment, particularly in wet areas, and are a normal part of the gastrointestinal tract. Stress, heavy worm load, or high amounts of grain with low fiber in the diet can cause rapid increases in *Clostridium* populations to toxic levels. Fortunately, vaccinations are available and effective and are usually found in a three-way combination commonly referred to as a CDT shot for prevention. Antitoxins and other treatments are available for individuals showing clinical signs. Vaccinate does one month before kidding to ensure antibodies are in the colostrum, and give kids a booster at about 6–8 and 10–12 weeks of age. Bucks will also need an annual CDT vaccination if clostridial diseases are a frequent problem on your ranch.

Coccidiosis is a leading cause of death in goats worldwide, particularly in those younger than 4 months of age (Harwood 2006). Parasitic protozoa of the *Eimeria* species cause coccidiosis, which is evidenced by diarrhea (often with flecks of blood or mucus), straining, rough hair coat, and loss of body condition in what otherwise should be gaining kids. The life cycle and route of infection of *Eimeria* are similar to those of parasitic worms. Limiting kid exposure to feces from older animals or separating feeding areas or paddocks by age class and keeping tidy housing can help prevent a high degree of coccidiosis. Stress from weaning, bad weather, predator attacks, or other sources can exacerbate clinical levels of coccidiosis in a herd. Coccidiosis can be treated with medication called coccidiostats, available at feed stores or clinics, or online.

Retention of the placenta after birth can be problematic. If the placenta is retained for more than 24 hours, remove and monitor the doe, as this may cause an infection that will need treatment with antibiotics. With smaller herds, infections can be further prevented in freshening does by washing their hindquarters after kidding.

Deworming does at or shortly after kidding and deworming kids at weaning is important, as the immune system is stressed during those periods. When stressed, otherwise perfectly productive breeders or market animals may be quickly overwhelmed by parasites and other secondary infections. The most effective deworming program determines and treats only those individuals that need treatment. This type of program can often be accomplished through various methods of fecal egg counting or a system like FAMACHA, which identifies anemic goats for treatment (see CTAHR's "An Introduction to Sheep and Goat Parasite Management in Hawai'i," available at http://www.ctahr.hawaii.edu/oc/freepubs/pdf/LM-24.pdf for more information). Deworm bucks shortly before turning them in with the does to help bring them into top condition. Selective breeding for individuals that are productive despite exposure to conditions favoring worms can be a strong preventative measure. Larger ranches, especially those that have goats primarily for weed control or as a secondary source of income, base their culling decisions on the need for deworming. In other words, if a doe or buck needs treatment it gets dewormed once and culled at the next opportunity. Over the long term, selecting for this resistance and resilience in your herd can greatly prevent parasite problems. Losses can be very high in the first few years if using this approach, so it may be more feasible with larger operations.

Check for lameness as a sign of hoof health issues in both bucks and does, especially before breeding (Figure 7). Animals suffering from hoof problems may not be able to mount or bear mounting and will thus not breed even if they are otherwise healthy. There are two general forms of hoof problems: foot scald, an inflammation due to environment (wet, muddy, overgrown hooves); and foot rot, a contagious infection caused by two anaerobic bacteria. Foot scald can be fairly easily treated by hoof trimming and treatment with topical medicine. Foot rot, which is evidenced by strong odor, hoof horn separation, or infection up the leg, is highly contagious and should be contained and prevented. Avoid mixing your herd with new individuals or neighbors until new animals are determined to be free of foot rot.

Kid health: At birth, tie off umbilical cord and dip in iodine solution to prevent infection, especially if kidding in pasture. Make sure kids get at least 2 ounces of colostrum in the first 24 hours after birth, as this is their only source of passive immunity. If there are problems nursing, colostrum can be hand-fed and stored frozen. If you are disbudding (burning off horn buds), disbud and castrate no less than three days after birth and no later than two weeks (between three and seven days is best). Deworm at weaning and monitor for parasites frequently.

Figure 7. Overgrown hooves can trap mud and feces, leading to an inflammation called foot scald. Monitor for lameness and treat as appropriate. Rocky areas in a pasture or access to pavement tend to help goats maintain their feet in good condition.

As bucks will be responsible for breeding up to 20 does, it is important to ensure they are in excellent condition to prevent open does. Monitoring bucks before breeding can be as sophisticated as a Breeding Soundness Exam or as simple as keeping an eye on common-sense physical problem areas. For example, examine for genital abnormalities in the testicles and sheath. If injured in these areas, a buck may appear healthy but will avoid breeding due to pain. In some places where forages may be deficient in micronutrients, bucks may need a selenium and vitamin E injection 30 days prior to breeding. Check with a veterinarian or local goat producers in your area. Periodic forage testing during the wet and dry seasons will help identify not only quality but also nutrient deficiency or toxicity issues.

Figure 8. Example of woven "hog wire" exterior fence with a cage wire skirt to prevent digging under. Others will use barbed and/or electric wire along the bottom to prevent burrowing.

Nutrition and Pasture Management

On average, a mature goat will eat about 2.8% of its body weight of a balanced diet on a dry matter (DM) basis every day. In other words, a 100-lb goat would need about 2.8 lbs of forage DM a day. Depending on your region and season, forage may contain 55–85% water. Therefore, at 85% moisture, this goat would eat about 19 lbs of fresh forage a day. Growing and lactating animals may eat more than this, and dry or non-breeding goats may eat less. Furthermore, a grazing goat can need up to 2–4 gallons of water a day depending on humidity and forage moisture content. Because goats use less water than other species and can be very picky about water quality, many producers tend to underestimate the importance of consistent, clean water for goats.

There are many ways to meet goats' nutritional needs, and each will vary in its proportion of labor time, infrastructure, and net payoff in production. For example, an extensive range system may have low fence and labor costs but may have low productivity owing to variable feed quality, predator loss, and poorly monitored health issues. On the other end of the extreme, a dry lot system using commercial feed rations for the bulk of the diet may be highly productive per animal, but net returns may be low owing to high input costs. Most meat goat systems in Hawai'i strike some balance between extensive range and intensive pasture management, with some supplemental feeding during critical periods. The system you choose will depend on your overall goals and capacity.

Intensive grazing systems for goats involve balancing forage health, animal nutritional needs, and parasite control. Good exterior fencing is a must for any goat operation, for keeping goats in and predators out (Figure 8). Goats are well known as master testers of fences and gates. Some goats even learn to open certain types of gate latches. If you don't know a lot about fences, goats will teach you. Most producers rely on woven "hog wire" fencing for exterior fences or those fences that surround the boundary of the property. Note that in operations where horns are left intact, a common problem is goats getting their heads stuck in the fence. Many producers run barbed or electric wire along the top and/or bottom on both sides of the fence to prevent dogs or pigs from attempting to dig under. Once inside the fence, dogs and pigs can have devastating impacts on all classes of goats. Many producers use a combination of traps, herders, or guard dogs to minimize losses and deter predators. Good guard dogs are becoming more common in Hawai'i, as they tend the herd 24 hours a day, seven days a week.

Intensive grazing management typically makes use of fixed hard wire or portable electric net fencing to move goats frequently onto fresh pasture. Portable electric fencing enables flexible, targeted grazing but requires labor and equipment costs. The purpose of frequent moves is for making use of optimum forage quality and to minimize parasite infection. Researchers have discovered that while occasionally parasite larvae can climb higher, for the most part infectious larvae crawl only about 2 inches up grass and up to 12 inches away from feces (Hale 2006). Therefore, keeping the average grass height above 3 inches and allowing large enough paddocks for animals to avoid fecal sites can help minimize the degree of parasite infection.

Moving animals before average grass height gets too low is also very important for forage species' health and protecting soil from erosion. The USDA Natural Resources Conservation Service has published minimum grazing height standards for several common forage

species in Hawai'i (Table 2). Determine forage height by marking a stick or boot and averaging the number of times forages are over or under this height (100 measurements can be taken very quickly).

Perhaps the most important factor for forage health is adequate time for pasture recovery from grazing. The amount of time for full recovery will depend on grazing intensity, season, and soil quality. Most grass species grazed moderately will need at least 30 days of rest in the summer and up to 90 days of rest in the winter. See CTAHR grazing management publications for more information: "Stocking Rate: The Most Important Tool in the Toolbox" (http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PRM-4.pdf) and "Foraging Behavior and Grazing

Table 2. Pasture management recommendations for common forages in Hawai'i. Table adapted from USDA-NRCS (2011).

Common Name	Scientific Name[1]	Minimum Height to Start Grazing (inches)	Avg. Height to Stop Grazing (inches)	Recommended Rest Period (days)[2]
Baron Goto grass	*Ischaemum polystachyum*	6	3	30–60
Big trefoil[3]	*Lotus pedunculatus*	8	4	30–60
Buffelgrass	*Pennisetum ciliare*	8	3	30–60
California, para, or buffalo grass	*Urochloa mutica*	24	6–8	18–40
Bermuda grass	*Cynodon dactylon*	4–6	3	18–40
Guinea grass, green panic	*Urochloa maxima*	18–24	8–10	25–40
Kaimi clover[3]	*Desmodium incanum*	12	4	60–90
Kikuyu grass	*Pennisetum clandestinum*	5–9	4	18–40
Napier or elephant grass	*Pennisetum purpureum*	18–24	8–10	25–40
Pangola grass	*Digitaria eriantha*	6–10	3	30–60
Perennial or pinto peanut[3]	*Arachis pintoi*	12	5–6	30–60
Stylo[3]	*Stylosanthes scabra*	12	4	60–90
Signal grass	*Urochloa brizantha*	6	4	30–60
Star grass	*Cynodon nlemfuensis*	8–10	4	18–40
Tinaroo glycine[3]	*Neonotonia wightii*	24	18	60–90

[1]Scientific names according to the USDA PLANTS database (http://plants.usda.gov/) as of March 2013.
[2]These rest periods are general recommendations only, with the shorter periods for high growth conditions and longer periods for slow growth conditions. Actual recovery time from grazing will depend on soil quality, time of year, intensity of grazing, and water availability. Periodic monitoring will give the best indication of grazing readiness.
[3]Leguminous (nitrogen-fixing) forage.

Management Planning" (http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PRM-2.pdf).

Animals should first be trained to electric fences before introducing them in a field setting. In other words, set up electric fences in a small paddock or pen for animals new to them so they learn an aversion. That way, if goats rush the fence and get over it, you will not have to round them up from a large pasture.

Pastures designed or improved for goats will include shrub species, typically legumes, to improve forage quality (Figure 9). Goats evolved in Near Eastern and Mediterranean regions with many brush species. Browsing up in branches as opposed to grazing down in grass adds another barrier between goats and parasite larvae. Planting shrubs in a pasture can also help add drought resistance to the forage system, as the deeper taproot system of brush can keep it green longer. From a nutrition standpoint, having protein-rich shrubs mixed with fiber-rich grasses enables the goats to mix their diet for optimum performance. Shrubs can be seeded into pasture in small sections protected from grazing with temporary fencing as needed. Leguminous species compatible with goats include pigeon pea (*Cajanus cajan*), stylo (*Stylosanthes* sp.), leucaena (*Leucaena leucocephala*), and gliricidia (*Gliricidia sepium*). Non-legumes include cassava (*Manihot esculenta*), kalamungay (*Moringa oleifera*), and panax (*Polyscias gullfoylei*). Establishment and management information for many of these and several other common species in Hawai'i can be found at the CTAHR Forages website (http://www.ctahr.hawaii.edu/forages/index.html) and the multi-agency Tropical Forages website (www.tropicalforages.info). Keep in mind that goats' preference for browsing generally precludes them from being compatible with valuable tree species such as orchard or forestry plantings.

Marketing Needs

Marketing options in Hawai'i are rather limited for producers of goats as compared to other livestock. Some slaughterhouses may accept limited amounts of goats, which are then sold to restaurants. Among certain ethnic groups, the demand is much stronger for live goats than for inspected, cut, and wrapped cabrito. There are also currently no sale barns for ease of selling breeding stock, weanlings, or other classes of goat.

Given these limitations, goat producers in Hawai'i should have a strongly developed marketing plan even if they are primarily interested in the production end. A bad situation to be in is to have several unsold goats using your pastures as your feed costs and potential for overgrazing go up each day they remain.

Individual marketing schemes depend heavily on reputation, consistency, and quality of supply. Marketing

Figure 9. Gliricidia (left) and pigeon pea (right), among others, are shrub species that can add to the quality and quantity of forage in your pasture and encourage goats' natural preference for browsing.

may be as simple as hanging a sign with your phone number, or you can solicit contracts with high-end restaurants. The type of marketing you pursue will depend on your preferences and willingness to accept market demands. For example, one neighbor island goat producer prefers to sell his goats to an O‘ahu wholesaler, even though he gets paid less per head than through direct marketing, because he can sell all his goats in one shipment rather than in multiple individual sales. Some goat producers maintain email lists and use them to announce however many animals are available, selling to individuals on a first come, first served basis. In whatever way you sell your goats, be sure to periodically get feedback from your customers to ensure you are meeting their needs. Frequent contact also gives you an opportunity to explain what your needs and limitations are.

Marketing is another area where parasite control is important. Many goat buyers use the intestinal tract for cooking traditional dishes. Goat producers report that these buyers take note very quickly of those ranches that consistently have goats with clean tracts. Know your markets, and note withdrawal times on any medications before bringing animals to market.

Specialized Uses of Meat Goats

Livestock producers in Hawai‘i and elsewhere in the U.S. are incorporating goats into a variety of situations. In Hawai‘i, an increasingly valuable role of meat goats is in weed and brush control for large cattle ranches (Figure 10). While turning to goats to manage plants problematic for cattle production incurs certain costs, the handful of large ranches using goats report they are more than worth the savings in labor and herbicide costs associated with spraying. Plus the sale of kids helps to offset those costs.

Related to weed management, municipalities and large landowners have been contracting with goat producers to maintain rights-of-way or for fire fuel buffer zones. Where terrain is too rugged to be safe or cost efficient to maintain with equipment, goats with a herder make an excellent alternative. By intensely grazing around properties or even whole towns, goats can create a break in fire fuel loads to help slow down fire advances across the landscape. These uses are often referred to as contract grazing.

Sometimes land managers want weeds managed but a particular crop plant left alone. In a process called conditioned aversion, goats and other livestock can be trained to avoid certain plants. Haleakala Ranch on Maui successfully trained goats to avoid a planting of an improved variety of *Leucaena leucocephala*. For more on this topic and other livestock behavior applications, see the BEHAVE program website of the Utah State University Cooperative Extension Service at www.behave.net.

To make more efficient use of pastures by multi-species stocking, Haleakala Ranch has tested “livestock bonding” methods to pair up cattle, sheep, and goats. Based on the work of Dr. Dean Anderson of the USDA Agricultural Research Service and other researchers, the ranch is testing whether bonded animals will use the pastures more uniformly and be easier to manage than non-bonded animals. While the ranch uses guard dogs, USDA researchers in New Mexico found that sheep and goats will hide among cattle when threatened by predators rather than running off and getting singled out. A brief video produced by the CTAHR Cooperative Extension Service documenting Haleakala Ranch’s bonding work can be viewed at http://www.youtube.com/watch?v=ywhB4ODFQsQ.

Figure 10. Big Island goats used primarily for weed control. In this case they are eating spiny amaranth (*Amaranthus spinosa*). Photo courtesy of Kapapala Ranch.

Frequently Asked Questions

How many goats can I raise, and how much space do they need?

The answer to these questions depends on many interacting factors, namely, how many goats you intend to market and their varying nutrition requirements, the quantity and quality of the pasture or feed throughout the year, and the efficiency of your management system. Start with determining how many goats you can handle yourself or how much help you can afford to pay for. Generally, one person can handle up to 30 does by himself or herself before needing additional help. This assumes a rather intensive approach to care: intensive grazing management, frequent health monitoring, feeding during critical times, trimming hooves, and assisting births, as well as maintaining off-farm jobs. In an extensive, low-input system, one herder may be responsible for several hundred goats.

How much space goats need again depends on many factors, but primarily the forage productivity of a site through the year. You can estimate annual forage demand based on the average amount a goat eats—2.8% of its body weight DM everyday. So the question to ask yourself is how much do 30 does (or 60 with one helper, 90 with two helpers, etc.), weighing on average 90 lbs. (or 80 lbs, 100 lbs, etc.), eat annually? See the following example:

Figure 11. Guard dogs, like this Akbash on Maui, are playing an increasingly important role in protecting herds against losses to pigs, dogs, and thieves. (Photo courtesy of Haleakala Ranch).

(90-lb doe x 2.8%DM/day) x 30 does x 365 days = 27,594 lbs DM forage per year

To protect forage and soil resources, we recommend allocating only half of the total forage production of a site to grazing. So in this example, a site would need to be producing at least 2 x 27,594 lbs or 55,188 lbs of forage during a year on a dry matter basis. You can estimate the productivity of a site by clipping, weighing, and averaging samples of fresh forage from a representative area (see CTAHR Extension Publication "Stocking Rate: The Most Important Tool in the Toolbox" for details). Pastures and range can have considerably variable forage productivity over space and time. For example, a site producing 12,000 lbs of fresh forage on average over the year (common for guinea grass pasture), at 80% moisture, would need to be at least 23 acres in this example (55,188 lbs forage demand ÷ [12,000 lbs/ac/year x 20%DM]). An improved napier grass or pigeon pea pasture with consistent, adequate rainfall may produce over 10 tons/acre, thus requiring only 14 acres for the same number of goats. Ultimately, forage productivity and the number of animals you can afford to handle will determine how much space is necessary for your goats. Err on the conservative side in your estimates to protect the health of your goats and pastures. And of course, forage does not grow if it does not rain (i.e., during a drought). Many livestock producers in Hawai'i stock low as insurance against unpredictable drought, and we highly recommend developing a drought-management plan. See the CTAHR Extension Publication titled "Management of Production Risk for Hawai'i Ranchers," available at http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PRM-5.pdf, for more information on drought and other risk-management planning.

Do I need guard dogs?

Losses to predation and theft can be sudden and devastating. One Big Island producer lost 26 out of 30 goats over the course of a week to wild dogs, despite spending several hours tracking them and waiting for them to return. Neighborhood dogs can also harass your herd, possibly leading to tension with your neighbors. Those

who have invested in good guard dogs across Hawai'i have not seemed to regret the money and time spent. As mentioned, guard dogs are with the herd all the time, after herders and owners go to bed (Figure 11). They are a highly effective deterrent to thieves and have been known to take on packs of roving dogs.

There are some considerations before purchasing guard dogs. The cost of dog food and veterinary care relative to the returns from goat sales can be high in small herds. As working dogs, they will need high-quality food and occasional emergency care when injured from fights with other dogs or pigs. Care must also be taken to be sure the dogs are bonded to the herd and not humans. This may be an issue with operations that have a high turnover of workers, as good guard dogs will be aggressive towards strangers. Their protective behavior may be a problem with neighbors or in areas bordering public venues. Guard dogs must not be considered pets.

Other animals have been used to protect goats. Burros and llamas have largely positive reports for protection. As these are large grazers, be sure to budget forage use for these types of guard animals.

Can goats really eat anything?

While it is true that goats tend to have a wider diet selection than other grazers in general, like any animal they need access to an adequate quality and quantity of feeds if they are to produce consistently. If forced onto a particular forage type due to limitation of their selection, goats may be exposed to toxic plants or experience problems caused by imbalanced nutrition.

Recipe: Easy Goat Adobo

3 lbs cabrito, cut into 1" cubes
1 medium onion, diced
6 cloves garlic, crushed
1 T fresh ginger, minced
2 bay leaves
¾ cup shoyu
¾ cup white vinegar
1 teaspoon black peppercorns, coarsely crushed

Place cabrito and onion in a slow cooker. Combine remaining ingredients in a bowl and pour over cabrito. Set on low and cook for 6–8 hours.

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