Camelid Wellness

Marty McGee Bennett, BS, Nanci L.M. Richards, DVM

KEYWORDS
- New World camelid • Nutrition • Feeding plans • Shelter • Acclimation
- Body condition scoring • Enrichment • Desensitizing

KEY POINTS
- Camelid feeding management for optimal health and performance is integral to individual and herd health.
- Basic shelter from storms and inclement weather should always be provided for camelids.
- Finding the right balance in feeding camelids is critical to their health and performance, and maintaining a camelid within the ideal weight range can be managed with proper attention to nutrition and exercise.
- Camelids are shy by nature and have not been selected over their 6000 years of domestication for close contact with humans.

DIET AND NUTRITION CONSIDERATIONS

New World camelids (NWCs) are represented by 4 species: alpaca, guanaco, llama, and vicuna. The alpaca and llama are the domesticated NWC species and are the focus of this article. Although frequently classified among ruminant species, camelids are not true ruminants because they have 3 distinct stomach compartments (C-1, C-2, C-3) as opposed to the 4 distinct stomach compartments of ruminants. However, the expanded first compartment is similar in many ways to the rumen because it is the location where the microbial fermentation of feed occurs and provides for remastication, or cud chewing. As with ruminants, dietary considerations concern not only the health of the overall animal but also the health of the microbes in the first stomach compartment. In the South American Andes, NWCs survive in the harsh environment by foraging on grasses, legumes, and forbs, and browsing on woody species, including the leaves, buds, and twigs, depending on what is available to them. This behavior holds true wherever they are found.

Camelid feeding management for optimal health and performance is integral to individual and herd health. The selection of feedstuffs to meet camelid nutritional needs should

Disclosure: The authors have nothing to disclose.

* Corresponding author.
E-mail address: marty@camelidynamics.com

1094-9194/15/$ – see front matter © 2015 Elsevier Inc. All rights reserved.
be based on the geography of their location, its abundances and deficiencies, as well as the management of the herd (free choice grazing vs dry lot). Each animal, and its health status, including age and intended purpose, dictates the specific nutritional requirements of that individual.\

A proper feeding regimen for NWC should always include a sustainable forage source, clean fresh water, and proper vitamins and minerals. Additional supplementation may be required to balance the diet or to address individual animal health conditions, as discussed later.

Forage nutritional profile measures include protein, carbohydrate, and fat content, as well as certain significant minerals (e.g., calcium, phosphorus, potassium and magnesium). Hays and pastures are analyzed for nutritional components such as crude protein (CP), total digestible nutrients (TDN; a measure of energy), neutral detergent fiber (a measure of digestible fiber), and acid detergent fiber (a measure of indigestible fiber). CP and TDN are some of the most commonly used measures to determine feed quality. As found in North American hays and pastures, the estimated NWC requirements of CP and TDN are 8% to 14% and 50% to 70%, respectively. The lower values address the nutrient requirements for maintenance and the higher values are appropriate for early growth or lactation in camelids.

It is typically advised to separate animals into like groups and feed them based on their individual needs, to ensure that each animal receives the proper amount and quality of nutrients. Examples of different living and feeding groups include breeding males, pregnant females, lactating females, nonreproductive females and geldings, and crias/weanlings. Also consider that weaker, thinner animals may be driven away from the food, whereas the stronger, more dominant animals may receive more than what is required for them. The following list provides a feeding approach based on certain animal groups and their specific nutrient needs. CP and TDN are frequently noted and discussed because they are often easily measured feed components from which to determine feed composition and quality. They are not the only considerations, but do provide a guide from which to begin to build an appropriate diet.

**ANIMAL GROUPS AND SUGGESTED FEEDING PLANS**

- **Lactation**
  - Nursing dam with cria: highest nutrient needs; high-quality forage plus supplementation, including minerals and vitamins as appropriate
  - From 12% to 14% CP, 60% to 70% TDN

- **Growth**
  - Weanlings up to 1.5 years: highest nutrient needs; high-quality forage plus supplementation, including minerals and vitamins as appropriate
  - From 14% to 16% CP, 55% to 65% TDN

- **Maintenance**
  - Males older than 1 year: low nutrient needs, unless working/actively breeding (adjust accordingly); low-quality to moderate-quality forage
  - Pregnant females in months 1 to 8: low nutrient needs, maintain body condition; low-quality to moderate-quality forage plus protein, minerals, and vitamins as appropriate
  - Breeding females: low nutrient needs, maintain body condition (not overweight or loss of proper condition); low-quality to moderate-quality forage, minerals and vitamins as appropriate
  - From 8% to 10% CP, 50% to 55% TDN (up to 60% TDN for breeding males)
• Late pregnancy
  ○ Pregnant females in months 9 to 11: moderate-quality to high-quality forage plus mineral and vitamin supplementation
  ○ From 10% to 12% CP, 55% to 70% TDN
• Submaintenance
  ○ Obese animals: lowest nutrient needs; low-quality forage plus mineral and vitamin supplement only (unless pregnant, then feed as described earlier)
  ○ From 8% to 9% CP, 45% to 33% TDN

Again, fresh, clean water is a vital component of proper camelid nutrition and should always be provided, along with the previously discussed feeds.

Supplementation (grain, pelleted feed) is often incorporated into camelid diets outside South America. Commercial supplements are available that are specifically formulated for camelids. However, as noted in the feeding regimens listed previously, all camelids do not require this type of supplementation.

In situations in which hay or supplements are fed, space is an important consideration with camelids to ensure that each animal gets an appropriate amount. Crowding creates competition, so more space is better. Providing multiple feeding stations is helpful.

Minerals are an important inclusion in the NWC diet as well. Knowledge of what the diet is providing and the geographic deficiencies and excesses should be considered. There are species-specific commercially prepared loose mineral blends available that address general needs. They can be offered free choice or top dressed at a specific rate (grams per day). Free-choice white salt (NaCl) should also be available for NWCs.

It has been documented that heavily fibered animals may experience seasonal vitamin D deficiencies. Of particular concern are crias born in the fall months in the northern hemisphere, and even other times of the year when camelids are located in areas where cloudy conditions may persist (e.g., Pacific Northwest). Supplementation with products containing vitamin D₃ (injectables or paste) has been suggested. Care must be taken in the dosing amount and frequency because toxicities can occur.

As with other nutrients, it is important to consider the geography where the animals are kept, and the surpluses or deficiencies therein, to address camelids’ mineral requirements. Selenium is one such element. In some areas soils are deficient in selenium and supplementation with oral or injectable minerals is recommended. In other geographic locations selenium can reach toxic levels through feeding certain grass hays.

In addition, NWCs are similarly sensitive to copper, as are sheep, and attention must be paid to the copper content of feeds, minerals, or other supplements that may be fed or administered.

HOUSING AND SHELTER

Basic shelter from storms and inclement weather should be provided. Housing provided can vary from a basic run-in shed (3-sided) structure to an enclosed barn with or without stalls (Figs. 1 and 2). Camelids are highly visual and seem to prefer a less closed-in environment, thus keeping their ability to identify threats intact. It is not surprising to find them staying outside rather than going into a barn, even during weather events. In general, porches attached to a barn are more desirable and more fully used than the inside of the barn. Shelter should also provide critical shade in hotter temperatures as well as the more obvious protection from rain, ice, and snow (Fig. 3). Providing proper ventilation is also important to the animals’ health and well-being. In hot climates fans are helpful for insect control and cooling.
Predator concerns can be addressed by providing a small pasture that is secure with high fencing and an electrified wire at the top and bottom adjoining a barn or porch, rather than closing animals in a barn at night or when left unattended. See Figs. 1–3 for examples of different types of housing for NWCs.

**Feeders and Feeding**

In their native land, llamas and alpacas forage widely to get enough to eat and therefore do not naturally compete for food. In view of this, feeding arrangements that require animals to eat in close contact cause stress and might prevent some animals from having access to adequate amounts of food. More feeder space is best and feeding at least some of their diet of hay on the ground outside in the pasture under the shelter of trees offers exercise, reduces competition, and provides a more

---

**Fig. 1.** Simple barn with panels used as dividers. (*Courtesy of April Polansky (photographer) and Fallengrund Alpacas, Butler, IL.*)

**Fig. 2.** Porches are the preferred loafing spot for camelids. (*Courtesy of April Polansky (photographer) and Fallengrund Alpacas, Butler, IL.*)
enriched environment. If animals must be fed in close proximity, using panels to create barriers between feeders can help reduce competition (Fig. 4).

SUBSTRATE
Camelids frequently lie in a sternal position, also known as kushing, and need proper surfaces to kush on. Therefore, if concrete is the flooring available, additional padding or bedding is recommended to reduce stress on the body, whether kushing, standing, or walking about. Rubber mats, straw, and similar substrates are appropriate. Wood shavings are not recommended because they contaminate the fiber and are difficult to remove. A sand substrate that can be soaked with water in the summer helps with cooling.

TEMPERATURE AND ENVIRONMENT
Camelids can live and thrive in a variety of climates and temperature ranges, but consideration should be given to their comfort for optimal health and peak performance. Provisions should be made not only for keeping the animals dry and warm in the winter but also to provide air movement or cooling in the summer.

Fig. 3. Simple shade shelters for hotter summertime temperatures. (Courtesy of April Polansky (photographer) and Fallengrund Alpacas, Butler, IL.)

Fig. 4. Panels dividing a larger area mitigate competition for hay and pellets.
The appropriate timing of fiber removal, or shearing, is one method of temperature control and thermoregulation. As fiber animals, shearing is done to harvest the fiber, but is also provides body cooling in hot, humid conditions. Shearing should take place in moderate temperatures so that the animals have a chance to acclimate before extreme temperature swings, while allowing them to grow a full fleece before the following winter.

Also to be considered is that very young, very old, small, or infirm animals may require additional warmth to maintain an appropriate body temperature. The local climate dictates the management required.

**IDEAL WEIGHT**

As previously discussed, finding the right balance in feeding camelids is critical to their health and performance. Tracking weight and body condition are measurements that help in assessing the animal. These parameters can serve as indicators of the overall health of the camelid.

Typical adult weights of the NWCs\(^\text{10}\):

- Alpaca: 55 to 90 kg
- Guanaco: 100 to 120 kg
- Llama: 113 to 250 kg
- Vicuna: 45 to 55 kg

Typical birth weights of NWC\(^\text{10}\):

- Alpaca: 6 to 9 kg
- Guanaco: 8 to 15 kg
- Llama: 8 to 18 kg
- Vicuna: 4 to 6 kg

Maintaining a camelid within the ideal weight range can be managed with proper attention to nutrition and exercise. Both extremes, being too thin and carrying excess weight, are detrimental to the animal's life expectancy, fiber production, and reproductive capabilities (e.g., fertility, lactation).\(^\text{11}\)

It is recommended that camelids be weighed regularly and have their body condition score (BCS) assessed. For adults, if the animal appears otherwise healthy, this can be done monthly. For crias, particularly neonates, weight checks daily or every other day for the first 2 weeks or more may be necessary to monitor for appropriate growth and development and measure the mothers’ lactation capabilities to meet the energy needs of the young crias. As long as the cria appears healthy, appropriately active, and well nourished, biweekly or even monthly weight checks until the cria reaches approximately 22 to 27 kg in body weight is typically adequate. At that point, weights can be coordinated with typical herd health checks. Scales are available that work well for camelids, but any scale that is safe, for humans and animals, and large enough to get an accurate weight, will work. Creating a system for weighing that does not involve haltering animals makes short work of the process and is easier and safer for the animals (Figs. 5 and 6A).

In addition to regular weighing, the BCS is a subjective grading system that requires feeling the animals by hand, to assess the subcutaneous fat mass of the animal. From this assessment, a number score is given on a scale of either 1 to 5 (which often includes increments of 0.5) or 1 to 9 (1 = very thin/emaciated; 5 or 9 = obese).\(^\text{12}\) Using either BCS scale is appropriate, as long as the denominator is known and remains constant.
Fig. 5. Training the animals to walk through the narrow lane and over a rubber mat.

Fig. 6. (A) Once accustomed to the process, individuals can be weighed without the need for haltering or leading. (B) Lumber region assessment of BCS (left to right): obese (BCS, 5 out of 5 or 9 out of 9); moderate weight (BCS, 3 out of 5 or 5 out of 9); very thin/emaciated (BCS, 1 out of 5 or 1 out of 9). (Courtesy of Stephen R. Purdy, DVM, Nuna Project and North American Camelid Studies Program, Amherst, MA; with permission.)
The primary location to begin the BCS assessment is over the lumber region of the animal (behind the ribs and in front of the hips). To do this, gently hold the animal by placing a hand with the webbed area between the thumb and the index finger snug along the backbone of the animal across the lumber region to feel the soft tissue mass compared with the prominence of the vertebral spinous process. Once a score has been determined, also compare with the prominence and fat covering the ribs and the fat mass between the hind and front legs to make minor adjustments to the score, if needed (usually no more than 0.5–1.0 score adjustment, in either direction). Fig. 6B shows high, medium, and low ranges of the BCS, across the lumbar region, and may help in making the assessment.

To be effective, these measurements (weight and BCS) should be recorded to track an individual camelid’s overall health. Trends or changes noted in the animal may help to identify problems or disease processes that should be addressed.

ENVIRONMENTAL ENRICHMENT

Paddock size is not as important as the availability of interesting and plentiful low-calorie forage and browse. Variation in the environment, such as the availability of hills, trees, roadside activity, and conspecifics, are more important than the size of the paddock. Although camelids get along well with other kinds of barnyard livestock they prefer the company of other camelids of the same species. A single llama or alpaca should never be kept alone without other camelids. Ideally llamas have other llamas and alpacas have other alpacas; however, sole llamas or alpacas accommodate to life with the other camelid species. Mixed herds of both species also work well and can be managed easily together. Camelids spend a lot of time eating but they also have a rich behavioral palette and the more enrichment opportunities you offer the more you see.

The following list of enrichments suggests some of the possibilities:

- Create browse by offering limbs
- Provide rotational grazing access to new areas periodically
- Offer hay in multiple locations outside requiring foraging behaviors when weather permits (Fig. 7)
- Offer a variety of hays
- Offer oat straw to extend the amount of time animals spend eating and ruminating
- Offer smaller amounts of hay more frequently
- Vary the location and method of offering hay, grains, and treats
- Provide scratching posts, street sweeper brushes, or brushes mounted on the wall (Fig. 8)
- Provide mirrors (Fig. 9)
- Add water features (eg, sprinklers, wading pools for summer)
- Provide varied terrain, such as a so-called king of the hill, which is easily created with fill dirt in the pasture
- Arrange pastures such that the animals have things to observe, such as traffic, bicyclists, and walkers

When adding dietary elements as enrichment, take care to consider the diet in total and make any changes gradually. The nutritional information provided earlier in this article should be considered the central part of a camelid diet. Regular weighing and body condition scoring provides the information needed to make sure that a diet is providing the appropriate nutrition.
MENTAL STIMULATION

Camelids require knowledge and skill to be caught, haltered, and led in a way that is palatable (discussed later); however, off-lead training using an event marker (clicker) and toys are universally met with enthusiasm. The following ideas represent some of the possibilities:

- A treat panel with holes covered by small, movable doors secured with 1 screw provides an interesting place to hide carrots. The animals will learn to move the panel aside to gain access to the treat (Fig. 10).

Fig. 7. Spruce tree branches are a particular favorite.

Fig. 8. Carrots create interest in the brush but, once they begin using it, the brush is reinforcing.
Little bowls with holes drilled in the middle and mounted on a dowel secured to a ledge creating the wobbly dish toy. Treats are placed between the small dishes (Fig. 11).

- Plastic jars with holes make carrot roll-arounds, similar to a buster cube for dogs (Fig. 12).

Mirrors have many uses: to provide interest in mineral feeders, to offer company for an animal that must be isolated, and to seem to be interesting to camelids (similarly to mirrors for birds).

Fig. 9. Mirrors have many uses: to provide interest in mineral feeders, to offer company for an animal that must be isolated, and to seem to be interesting to camelids (similarly to mirrors for birds).

Fig. 10. A homemade treat panel.
In the wintertime, caching food in snow holes or at the far edges of the pasture can provide additional opportunities for foraging, investigating their environment, and for exercise. This searching appeals to their seeking instincts and desire to search for food (Fig. 13).

Clicker training is remarkably efficient and fun. Given that clicker training is positive reinforcement based, it has the added benefit of ensuring that the animal is a willing participant. Off-lead work is an effective way to increase the level of trust between human and camelid. Target training is both fun and useful in herd management and training. The imagination is the only limiting factor. Mazes, jumps, weaving between poles, walking through hoops, standing and sitting on rugs, walking through a tunnel, and ringing a bell are all activities that camelids enjoy (Fig. 14).

Getting camelids to try new things often involves food. Grain works, but carrots, grapes, and garden vegetable treats are preferable to too much grain or other sugary treats. Just because a camelid will eat something does not mean that it should be used for enrichment. Make sure that healthy foods are being offered. If camelids do not know about healthy treats, it can be a challenge to get them to try a new food. Here are a few ideas:

- Cut the new food up into very small pieces that are easily chewed
- Introduce the food to a grain treat that your animals already like
Mixing shredded carrots in with alfalfa leaves can encourage the animals to acquire the taste, because it is difficult to separate the small bits of carrots from the leaves.

- Be persistent

**BEHAVIOR TRAINING FOR HEALTHY INTERACTION WITH OWNERS**

Camelids are shy by nature and have not been selected in their 6000 years of domestication for close contact with humans. A camelid’s long neck provides the handler a...
significant and potentially dangerous amount of leverage. Coupled with a small head, this leverage provides a significant challenge when it comes to haltering and leading (Fig. 15). For positive interactions with camelids it is necessary to spend some time desensitizing the animal to human approach and proximity.

**Handling Area Setup**

Using laneways leading to a smaller paddock and ultimately to a catch pen (no larger than 3 × 3 m [10 × 10 feet] square and 1.2–1.5 m [4–5 feet] in height) makes catching easier and more palatable for the animals (Fig. 16). Calling the animals in for a food treat is a good initial plan but a well-designed system that allows handlers to move animals to a confined area with herding tools is crucial for good management. The use of 1.2-m (4 foot) herding poles allows handlers to communicate with camelids from a distance, which is easier and safer for the animals (Fig. 17). Tying a rope or using a nylon tape attached to the corner of a paddock allows handlers to create a temporary fence or laneway leading to a smaller area (Fig. 18). Ropes or herding tape is not suitable for trapping animals in a corner. Herding tape is only useful for creating a temporary path to a safe handling area.

A handling area with pens of various sizes, including 2.7 × 2.7 m (9 × 9 feet) and 1.2 to 1.5 m high (4–5 feet), which is useful for catching, haltering, restraint-free injection, and other management tasks; 2.7 × 0.9 m (9 × 3 feet), which is useful for trimming toenails; and 2.7 × 8.2 m (9 × 27 feet), which is useful for initial lead training, allows handlers to work with containment instead of using restraint (Fig. 19). Owners who do not have a proper setup but who own trailers can use a trailer as a handling area. Parking

![Image](image.png)

**Fig. 15.** The further away the head is from the center of mass the more leverage control of the head offers the handler. It is important to use this additional leverage responsibly. (From Bennett M. The camelid companion. New Smyrna Beach (FL): Raccoon Press; 2001. p. 93; with permission.)