



#6 – Keeping Feed Costs Down

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Introduction

This fact sheet is an overview of methods for controlling feed costs in meat goat herds. Costs for livestock feed, in particular concentrate feeds, increased sharply during 2007 and 2008 reinforcing the volatility of these costs. In the current economic atmosphere, herd viability can be improved by adopting herd management practices that more effectively use forages and concentrates and identifying marketing practices to purchase feeds at lower prices.

Forages

Goats are small ruminants. Similar to other ruminants, their digestive system is designed to obtain energy from the volatile fatty acids that result from the fermentation of fiber by rumen microorganisms. Therefore, their natural diet is comprised primarily of plant fiber in forages instead of grain carbohydrates. Goats are considered versatile feeders with a preference for forbs (broadleaf plants with succulent stems) and browse (broadleaf plants with woody stems). However, they prefer a varied diet and readily eat grasses as part of their daily diet and even preferentially at certain seasons of the year.

Forage quality

Not all plant fiber is readily fermented by rumen microorganisms. Furthermore, the passage of food through a small ruminant is faster than through large ruminants. This means that goat rumen microorganisms do not have as much time to break down plant fiber. Therefore, they are not able to convert the more lignified (i.e., lower quality) fiber found in mature plant stems into nutrients that can be used for energy. Rather, goats have a mobile upper lip allowing them to selectively choose the most fermentable plant fiber, the growing points of plants instead of

mature parts and the leaves of plants over the stems. As an aside, this strategy results in goats naturally choosing to include as part of their diet, the fruit and seeds (grain) borne at plant growing points, rather than naturally limiting themselves only to a “grassfed” diet.

A healthy goat’s diet should provide sufficient high quality fiber readily fermented by rumen bacteria to maintain rumen health. High quality forage and many grain byproducts (soy hulls, wheat middlings, etc.) are potential sources of fermentable fiber for goats. When concentrate prices are high, one of the best ways to keep feed costs down is to invest in quality of forages. This can be done through wise pasture management and/or the harvesting of forages at sufficiently immature growth stages so that they consist chiefly of leaves and less mature, pliable stems as compared to mature, brittle stems. Keep in mind that the mature stems of legumes (alfalfa, clover, etc.) and “C4” grasses (Sudan, Johnson, etc.) tend to be more lignified and thus, poorer in nutrition, than the stems of cool season “C3” grasses (Timothy, Orchard, etc.).

Goats are very susceptible to stomach and intestinal worms. Because of this, goat pastures may need to be rested longer between grazing intervals than is optimum for forage quality. To keep pastures from becoming mature too early in the grazing season, pastures can be bush-hogged or grazed in between the goat grazing intervals by other animal species such as cattle or horses that are not hosts to the same worms.

The nutritional value of brush pastures will also decrease over the grazing season as the vegetation matures. However, the degree of loss is less than for conventional pasture species. Browse plants take a long time to recover from grazing and may only be able to be grazed once or twice per year depending upon how much defoliation occurs at each grazing unless the goal is to eradicate the brush. If the goal is to sustain brush, wait to graze brush in the spring until the plants are completely leafed out and avoid grazing in the fall when goats are likely to girdle the bark. Brush pastures are a likely habitats for deer, putting goats at higher risk of neurological

damage from deer worm infection, particularly when snails and slugs, the intermediate host of deer worm are numerous (i.e. during wetter times of the year or when leaves drop in the fall).

The cost and availability of high quality forage can vary from farm to farm and season to season. Lactating does and growing kids have the highest nutritional demands in a herd. When comparing different breeding schedules, be sure to account for seasonal differences in costs and availability of high quality forage in order to insure reasonably priced, good quality forage for the does during late pregnancy and lactation, and for recently weaned kids.

Types of forage

Forage can be preserved either by drying (hay) or pickling (silage, haylage and baleage). Pickling occurs when naturally occurring beneficial bacteria produce lactic acid while breaking down some of the fermentable fiber in forage. Unlike baleage, both silage and haylage are chopped and can therefore be more reliably fermented or pickled than baleage.

If baleage is processed or stored improperly, the acidity of it may not be low enough (pH ≤ 5 considered very safe, 5 to < 6 increasingly risky, ≥ 6 should not be fed) to kill the listeria bacteria which can proliferate in it. Goats become infected when they eat the contaminated baleage. They then shed listeria in their milk and manure where it readily infects nursing kids resulting in listeriosis, an often fatal disease for both adult and kid goats. High risk baleage generally results from 1) cutting forage when too mature to have sufficient fermentable fiber, 2) having the forage get rained on after cutting, 3) letting forage get too dry (40% to 60% moisture optimal) before baling and wrapping, 4) insufficient compacting of the forage, or 5) contaminating the baleage with oxygen after wrapping. Each time baleage is moved, the chances of the plastic wrap tearing and air getting in, increases. pH meters or soil pH probes can be used to sample baleage prior to unwrapping and feeding but need to be accurate to ± 0.1 .

Hay is a safer choice than pickled forage particularly for small producers and is often put up as either small square bales or large round bales. Round bales can be stored outside where they will develop a hard shell from repeated rains. However, the yield of edible hay from a weathered round bale is only about two thirds of its original weight. For example, a 600 lb round bale stored outside will only yield about 400 lb of feed. Round bales are also more difficult to move compared to small square bales and may require hay spike attachments on tractors depending on their weight and how far mangers are from storage. Soft center bales are usually lighter weight than hard core bales but are made using a fixed chamber thus their width and potential weight can not be adjusted. In some cases the bales are unraveled in the barn and fed out in small amounts. The brittle shell of weathered round bales can be cut with a chain saw if necessary. Synthetic and/or unweathered twine should be removed prior to feeding to eliminate the risk of animals strangling. Round bales are sufficiently large to smother a kid if they tip over. Special round bale feeders or inline fence feeders often made using metal mesh livestock panels can be used to cut down on hay waste and possible kid injury.

Buying forage

In rural regions of the Northeast US, hay is usually cheaper if bought direct from local hay farmers rather than buying through a feed store or hay broker. Because goats are versatile eaters, a good quality goat hay can often include nontoxic broadleaf weeds that would lower the quality of the hay for other livestock. Many broadleaf weeds such as immature goldenrod, plantain, curly dock, and dandelions are readily eaten by goats and can contribute to the quality of the hay while possibly providing an opportunity to purchase hay at a lower price. Costs of purchasing hay straight out of the field are often less than out of the barn. However, you need to be ready to unload hay wagons immediately if rain is imminent or the wagons are needed back right away. If buying from hay brokers, find out what the additional charges are for delivery and

whether the delivery charge includes any assistance for unloading and stacking. Get a price per ton rather than a price per bale when comparing hay prices from different sources. If only bale prices are available, find out how many bales are supposed to be in a ton (weigh sample bales to confirm) and then convert to price per ton. For example, a hay costing \$3.00 per square bale and weighing 40 lb (1 ton = 2000 lb, 50 bales = 1 ton, $\$3.00 * 50 = \150 per ton) will be more expensive than a similar quality hay costing \$3.50 per 50 lb bale (40 bales = 1 ton, $\$3.50 * 40 = \140 per ton).

Hay should not be stored at more than 14% (round bales) to 18% (small square bales) moisture in the Northeast US. A moisture gauge can be used for measuring moisture. Borderline bales should be fed out right away or have their strings or wires cut to reduce the chance of fire. Hay temperature on suspect bales can be monitored the first few days, with most hays losing much of their nutritive value if the bale temperature reaches 130° F or above and the chance of fire progressively increasing.

Square bale hay is usually cheaper at harvest time than in late summer or fall when farmers have already gone through the labor of storing it. Hay is normally more expensive in late winter and early spring unless a farmer has surplus hay from the previous year that needs to be moved in readiness for harvest. Hay can also be purchased through local and regional hay auctions. Check with livestock auction barns, shopper newspapers, and feed stores to find out about the availability of hay auctions. Be sure to arrive in sufficient time to inspect different hay loads. Small and large quantities are usually available. Check to see if delivery to your farm will be included in the price bid and whether you are expected to pay an additional buyer fee to the auctioneer.

Feeding forage

How you manage the forage feeding is important. Separating the herd into different production groups (strings) allows you to conserve the highest quality forage for the animals that need it the most. Dry does and does in early to mid pregnancy can usually be managed together while very late pregnancy and nursing does should be in a higher nutritional group. Growing doelings usually need to be managed separately, especially until they reach breeding age. If space allows and feed resources warrant it, herds can be further divided into doelings and/or yearlings versus older does, or does with large litters (yearlings with twins or more, older does with triplets or more) versus does with smaller litters. In contrast, commercial dairy goat herds are often divided by stage of lactation or daily milk yield.

The management of forage waste is also an important consideration. Goats are fastidious eaters and will generally avoid soiled hay. Therefore, feeding forages in mangers (provide 1 linear foot of manger space per adult goat) rather than on the ground is a very effective and simple way to reduce feed costs by reducing feed waste. Intuitively, it might seem that 1) the best mangers are those that eliminate all waste, and 2) that forage costs can be reduced if animals are fed only as much forage as they will clean up completely. However, some mangers designed to eliminate all waste run more risk of strangling goats. The longer, coarser hay that goats tend to pull out of mangers actually contributes substantially to bedding of the barn during winter months. Bedding materials such as straw often cost as much or more than hay so this wastage can significantly reduce bedding costs.

As mentioned earlier, goats are selective eaters. One simple way to increase forage quality is to permit goats to exercise their ability to selectively choose the most nutritious parts of the forage to eat. However, the amount of wastage (i.e., refusal) that should be allowed depends on the quality and cost of the forage and the nutritional needs of the goat. For example, Dr. Peter

Van Soest, one of the world's leading ruminant nutritionists, recommends allowing about 15 to 20% refusal on high quality hay and 35 to 50% refusal on low quality hay for dairy goats being fed for maximum milk production. The refusal rates you permit would be far lower for goats with low nutritional needs such as dry, mature does. When nutritional needs are high, feed a high quality hay and permit little refusal versus feeding a low quality hay where copious preferential sorting may be necessary to meet nutritional needs.

Concentrates

The fruits and seeds of plants contain concentrated energy in the form of nonstructural carbohydrates (starch and sugars). Livestock in the United States are commonly fed some grain or grain byproducts. The rationale is that concentrates contain about 75% total digestible nutrients (TDN) on an as-fed basis as compared to about 50% TDN for dried forages. Therefore, if concentrates are available for ≤ 1.5 times the price of hay, the purchase of concentrates makes financial sense based upon the cost per pound of nutrient. Keep in mind that if the TDN in the concentrate is only 70% and the hay is good quality with a TDN of 55% then the price of the concentrate would need to be ≤ 1.3 times the price of the forage. Even when concentrates are more expensive than these guidelines, the addition of concentrates to livestock diets is often viewed as financially beneficial if it allows the carrying capacity of the farm to increase or if the concentrate is serving as a protein supplement to make up for protein deficiencies in the forage. Furthermore, feeding concentrates dilutes each animal's maintenance cost over more growth or milk production. This gives concentrates added economic value, especially because there is a daily interest or opportunity cost for growing animals.

Amount of concentrate fed

However, the law of diminishing returns holds true for the feeding of nonstructural carbohydrates, i.e. grains, to ruminants such as goats on the basis of feed efficiency, feed costs,

and animal health. Adding a small amount of nonstructural carbohydrates to an animal's diet will initially increase the amount of feed the animal consumes. However, as more grain is added to the diet, it starts substituting for more and more forage on a pound to pound dry matter comparison. Not only that, but eventually the amount of increase in weight gain or milk production that can be expected per additional pound of grain feeding starts to drop. You get your biggest bang in terms of feed cost and efficiency for the initial additions of nonstructural carbohydrates.

This same principle works in terms of pasture efficiency. A limited amount of grain feeding can increase the carrying capacity of a field. However, as more grain substitution is allowed, the goats will graze the pasture more selectively and with less efficiency. Pastures will tend to get ahead of the herd and mature more rapidly resulting in reduced pasture productivity. Most of the costs of pastures are fixed (taxes, fencing costs) and it makes poor sense to use them inefficiently. The feeding of some grain also allows goats to be more selective in terms of harvested forage. This can be advantageous if the forage quality is borderline or poor and the herd can benefit from selecting the choicer portions. However, if pasture or hay quality is good, unwarranted selection due to grain feeding can result in the consumption of only the most tender parts of the plant threatening not only forage efficiency but herd health.

As the feeding of nonstructural carbohydrates increases, goats consume less and less of the forage and, unless the "grain" feed has been formulated with sufficient fermentable fiber from by-product ingredients, rumen microorganisms may not have sufficient fermentable fiber. Instead, rumen metabolism is disrupted as starches and sugars are oversupplied and the rumen pH becomes too acidic. Animals in a minor state of acidosis will generally have reduced appetites and lower concentrations of fat and protein in their milk (i.e. the milk they are producing for their young will be less nutritious). In contrast, severe acidosis generally results in

death. Although, diets that encourage mild acidosis can be buffered with compounds such as baking soda (sodium bicarbonate), the direct solution is to increase the concentration of fermentable fiber available in the diet compared to starches and sugars. This can be done by 1) increasing the proportion of good quality forage fed compared to concentrate or 2) making sure that the concentrate fed includes significant amounts of good quality structural carbohydrates in the form of grain byproducts such as soy hulls or wheat middlings.

Managing kids for maximum weight gain may not be financially warranted particularly as kids approach mature size and weight gains are attributed more to increased body condition rather than actual growth. The exception to this is the effect show wins can have on the sale of breeding stock. However, in this situation it may make more sense to manage a select show string separately from your commercial herd depending on feed costs, fixed costs, and prices received for slaughter kids and breeding stock. Managing a show string separately from the rest of the herd also allows breeding the two groups at different times. For example, the show season generally coincides with the grazing season. Therefore, it may make sense to breed your the string earlier so that they are dry (maintenance needs at their lowest and body condition best) during the show season even if it is most economical for your herd to raise lactating does and nursing kids on pasture during the same season.

Feed efficiency and cost are major determinants of the financial well being of a commercial herd and the amount of concentrate supplementation provided needs to be judged on this basis. However, keep in mind that raising goats to meet the “grassfed” label (i.e. feeding no concentrates) often results in slower growth rates and delayed time to market. The profitability of “grassfed” operations is dependant on 1) the provision of good quality forages high in fermentable fibers and 2) sufficient higher prices to offset longer times to harvest or lower carrying capacities.

Feeding concentrates – considerations for management and physical form

Dividing the herd into management groups makes sense for feeding concentrates as well as forages. Dry does often do best without any concentrate feeding as compared to late pregnancy does, lactating does and growing kids. If lactating does are fed good quality forage with little or no concentrate supplementation, their nursing kids often benefit from creep feeding; especially for kids from large litters or when rapid growth is needed to meet market targets. If no creep feeding is done, separating the lactating doe herd according to litter size will permit additional concentrate supplementation for does with large litters as compared to small litters. Does can also be grouped by body condition score prior to breeding or during pregnancy so that a concentrate can be fed to those needing to gain weight. Managing your herd in groups also permits the use of different feed handling methods for different groups. For example, highly competitive groups of weaned kids may benefit from the use of self feeders while the remainder of the herd may not.

Concentrates can be purchased in many forms. Barley, oats, and sorghum can often be fed as whole grains directly after combining. Hulling, rolling or cracking of these grains to improve digestibility is not as necessary for goats as compared to large ruminants which tend to swallow these grains whole. In contrast, it is generally recommended that millet and wheat be fed ground even to small ruminants. Ear corn harvested at <20% moisture can be safely stored in corn cribs and fed out over the winter. Keep in mind that 75 pounds of ear corn harvested at 20% moisture is equivalent to about one bushel (~56 lbs) of shelled corn. In contrast, if harvested at 15% moisture, 70 lbs of ear corn is equivalent to a bushel of shelled corn. In the Northeast US, shelled corn is usually harvested at too high a moisture content for safe storage unless put up in silos as high moisture corn. Instead, it is normally dried artificially after harvest to a moisture content of 14% or less for easy storage. The small tapered muzzle of goats allows them to readily

mash whole corn rather than swallowing it whole as cows and horses tend to do. Thus, corn is quite digestible to goats without cracking, grinding or rolling and the slight improvement in digestibility promoted by these practices may not be economically warranted.

Grain mixes generally contain a mixture of grains, processed to varying degrees and combined with dietary supplements. Supplements generally include iodized salt, no more than 5% molasses or vegetable oil to keep the dust down (alternatively, water can be added at about 5% just prior to feeding), calcium and/or phosphorous supplements, and a vitamin/trace mineral pack to provide necessary minerals (selenium, copper, and possibly zinc), and vitamins (A, D and E) that are typically lacking in NE US winter feeds or not easily synthesized by rumen microorganisms.

A coccidiostat such as decoquinate (Deccox®), monensin (Rumensin®), or lasalocid (Bovatec®) may be added to help cut down on the coccidia content of animal feces and hence reduce the risk of this internal parasite population increasing rapidly and causing serious problems for young stock. Deccox® is licensed for both meat goats and sheep and is safe for horses. Rumensin® is licensed for meat goats but not sheep and is deadly to horses. Bovatec® is licensed for sheep but not goats and is potentially toxic to horses. Your veterinarian may recommend the addition of ammonium chloride to the diets of bucks and wethers combat the formation of urinary stones and reduce the risk of urinary calculi by acidifying the urine. Because ammonium chloride is a source of non protein nitrogen, it will increase the potential crude protein content of the feed. If other non protein nitrogen sources are being fed, such as urea, care should be taken that the level of total non protein nitrogen being fed does not exceed safe, legal levels.

Selective eaters such as goats tend to sift through feed mixes and preferentially pick out their favorite portions. This is particularly true when the diet is fed in large enough amounts that

it is not immediately consumed. One example of this is when forages have been chopped or ground and mixed with grain and minerals to make a Total Mixed Ration (TMR) for safe free-choice feeding. Goats may preferentially select out the grain in the TMR. This may result in a diet prone to acidosis and not safe for free-choice feeding.

In contrast, goats can not selectively pick through either a pelleted or completely ground feed or TMR. An advantage of this is that the goats will consume a representative share of the minerals, vitamins, coccidiostats or ammonium chloride that the diet was formulated to provide. However, this can be a disadvantage when a hay source such as alfalfa has been pelleted because the goat can no longer reject mature stems in favor of more nutritious plant parts and will only be able to derive as much nutrition from the hay as in the hay originally.

One way to insure the safe consumption of either TMRs or concentrate mixes is to provide a significant portion of your concentrates in the form of grain byproducts that are high in fermentable fiber rather than sugars and starches. Examples of some grain byproducts that excel in fermentable fiber are wheat middlings, soy hulls, whole cottonseed, corn gluten feed, distillers' grain, and beet pulp. A quick way to estimate the potential fermentable fiber (pFNDF) content of a feed ingredient from a feed tag or feed analysis is to calculate

$$\text{pFNDF\%} = \text{NDF\%} - ((100 - \text{TDN\%}) - \text{FML\%})$$

where NDF = neutral detergent fiber, i.e., structural carbohydrates, TDN = total digestible nutrients, and FML is an estimated value from 10 to 15 representing fecal metabolic loss. The loss of dietary dry matter in the feces (FML) is ~10% for grains, ~12% for byproduct feeds and ~15% for forages. For example, a high quality sample of wheat middlings might have NDF% = 43, TDN% = 80, FML% = 12, leading to the following equation:

$$\text{pFNDF\%} = 43 - ((100 - 80) - 12) = 43 - (20 - 12) = 43 - 8 = 35\%.$$

Buying Concentrates

Grain prices tend to be cheapest around harvest when surplus grain needs to be moved out of storage to make room for the new crop and when the new crop has yet to accumulate any storage costs. There are several web sites that list commodity prices for various grains and allow you to track price trends. Organic grains may cost considerably more than conventionally grown grains due to the increased cost of producing them.

Bagged feed

One of the most convenient but costly ways to buy concentrates is purchasing major brand goat mixes at conventional feed stores or feed franchises. A big marketing point used by these major brands is that their goat feeds are formulated especially for goats. However, all of them have to make guesses about the type and quality of forage available so the accuracy of the formulation in matching your goats' exact nutritional needs are probably questionable. In truth, nutrition does not need to be an exact science in order to raise healthy animals.

Purchasing individual bags makes storage easy for small herds as bags can be easily stored in rat proof metal garbage cans or oil drums. Keep in mind that rats can easily chew their way through most plastic tubs. Feed does not go stale and vitamins and coccidiostats do not lose their potency because feed is being purchased in a timely manner. Many feed stores will sell bags by the ton for a volume discount. Even when using small quantities of bagged feed at a time, check with your feed store or dealer about getting the volume discount. It may be possible still pick bags up individually as you need them. This scenario is most likely to occur in years when feed prices remain fairly constant as compared to 2008 when feed prices were often increasing on a weekly basis.

Handling individually bagged feed can be a nuisance for larger herds. Bags are not rat proof. Therefore, the storage of large numbers of bags is difficult. Furthermore, feeding out from bags as opposed to bins takes extra effort. Most feed companies sell feed in bulk for an additional discount. They can also deliver bulk feed direct to your farm for an additional cost. When buying feed in bulk, find out what is the minimum order size and calculate how long it will take to use a minimum shipment. Keep in mind the potency period for dietary supplements included in the mixes. If so, dietary supplements can be provided separately. For example, coccidiostats can be provided in a loose trace mineral salt fed separately or periodically in the drinking water.

Find out what sort of storage is required for the bulk feed. The delivery truck will need close access to the storage when delivering bulk feed whereas they may be able to meet you at the bottom of your driveway to transfer their feed to your truck or wagon if the feed is delivered in individual bags. Most feed delivery trucks are set up to auger or blow the feed into top loading grain hoppers. Some feed companies are willing to blow the feed into low level feed bins or into 50 gallon drums or barrels.

Local feed mills

Local mills are another option for buying concentrates. Many mills employ nutritionists to help formulate diets with the flexibility to change formulas slightly as prices for various grains and byproducts change. Find out the minimum amount that must be purchased in order for the mill to mix specialized diets and the additional costs and minimum amounts required for special services such as pelletizing, individual bagging or delivery. You may be limited to a ground mix if the mill does not have a pelletizer. Find out if the mill already produces an economical diet suitable for your goats. The mineral and vitamin levels may need to be modified slightly for

goats. For example, goats tolerate more copper than sheep but less than the upper limits for cattle.

This fact sheet includes some general information to help you formulate diets (Appendix I). It also includes an incomplete directory of mills that formulate diets (Appendix II). Appendix III includes several diets developed by local goat farmers or the Cornell Department of Animal Science that can be shared with local mills. If you do not know a local mill near you, check with nearby cow dairies, feedlots or horse boarding/training stables to get suggestions. In addition, larger scale farms are occasionally willing to sell small quantities of the concentrates that they routinely buy in bulk. However, keep in mind that these businesses usually can not spend much time or labor on such transactions.

When creating a diet or sharing one from another mill, it is very important to consider what other supplements will be fed and adjust the diet accordingly. For example, the diet may be lacking in iodine, therefore predisposing your animals to a dangerous iodine deficiency, on the assumption that you are providing an alternate source of iodized salt. The diet may be too high in a specific trace mineral such as selenium or copper or a coccidiostat such as Deccox if a loose salt containing these additives is offered. Mills must follow strict guidelines on legal limits for most feed additives to insure a high level of safety. Thus, the diet that you propose may need altering to meet these constraints. However, these constraints also insure fairly wide safety margins in the event of accidental feeding of additives from multiple sources.

Direct from farmer or processor

Another option for buying concentrates is to go straight to the source and buy your grain direct from a farm. Most corn farmers have the capacity to dry corn. However, not all farmers have the capacity to crack, roll or roast grain. However, as mentioned earlier, goats efficiently digest most whole grains and beans, including raw soybeans.

Whole grains are high in phosphorous and low in calcium and do not mix easily with sources of supplemental calcium such as feed quality limestone. Thus they may provide too much phosphorous compared to calcium for male goats that are already predisposed to urinary calculi (optimum Ca:P ratio to prevent urinary calculi is 2:1), potentially resulting in urinary blockages and possible death from ruptured bladders. ***Additives such as ammonium chloride to prevent urinary calculi are also difficult to distribute in whole grains.*** Instead, calcium supplements can easily be added to loose trace mineral salts fed free choice. Additionally, water acidifiers (for example, Acid Pak 4-Way 2X Alltech®) can be added to male goats' water.

When buying direct from a farmer, find out whether the grain can be individually bagged if you provide and reuse bags or whether you need to buy it loose. Check whether there is a scale or whether you will be buying by the bushel or needing to drive the grain over a local weigh scale. If buying by the bushel, know grain weight equivalents so that you can compare farm and mill prices. Is the farmer willing to store the grain if you buy it in advance or will you need to take charge of all the grain at one time? Can the farmer deliver the grain and, if so, can he get it into your storage? Keep in mind that the price a local farmer charges will depend on more than national commodity price quotes. What are grain prices like regionally? How much extra time is needed to handle small quantities of grain for individual buyers rather than contracting the entire crop to one large scale buyer? What are other local customers such as homeowners needing corn for their corn stoves willing to pay? On the other hand, when farmers sell locally they avoid transportation, handling, and broker charges associated with selling on the open market.

Vitamins, minerals and coccidiostats can be purchased separately and mixed into feed on the farm. If the feed additive is very concentrated, first dilute it in a portion of the grain mix prior to adding the diluted mixture to the daily feed. Sources for dietary supplements can be found on the web (see Resources) and may sell directly to you or through a local feed dealer or mill.

Even if you or the grain farmer has a grain mixer, feed additives are difficult to evenly distribute into whole grains. Another option is to provide additional minerals and vitamins in the form of a loose trace mineral salt fed separately. Several trace mineral mixes are available with a coccidiostat added to them.

Another way to buy direct from the source is to obtain grain byproducts directly from processors. As mentioned earlier, many grain byproducts (soy hulls, wheat middlings, corn gluten feed, distiller's grain) contain high levels of fermentable fiber. Most are finely ground so that it is easy to evenly distribute feed additives in them. To cut down on their dustiness, about 5% molasses, vegetable oil or water (1 qt water = 2 lb) can be added prior to feeding. If water is used, to prevent molds from forming it should be mixed with the feed as it is fed out rather than being added earlier. Trial and error at the Cornell Sheep Farm has shown that about 5% added water should be included to minimize dustiness of ground feed without inducing mold or causing feed handling problems.

When buying from a processor (pancake or flour mill, brewery, ethanol plant, etc.), find out the minimum quantities they will sell for volume discounts and compare prices with local mills or feed stores. In many cases the byproducts are stored overhead in huge 1 ton bags that can only be unloaded by driving open bed trucks or pickups below them. Normally you will have to provide delivery. Occasionally, you can contract with truckers from local feed mills to deliver large quantities from the processor direct to you. The processor may also be able to suggest possible truckers.

Concentrate Storage

One constraint to buying concentrates in bulk from local farms, processors, or mills is the need to provide your own on-farm bulk storage. Fifty gallon metal or plastic drums with tight fitting lids will hold approximately 6 bushels (1 bushel is equivalent to 32 quarts) or 350 lb of

whole corn each as compared to ~200 lb of whole oats (~1 lb per quart). Pellets generally weigh about 1¼ to 1½ lb per quart depending on the amount of heavier feedstuffs such as molasses in them.

Chest freezers (1 cubic ft holds about 1.2 bushels) fitted with locks or with rubber gaskets removed to make them child safe also make excellent rat proof grain bins for small farms. Broken or old freezers are readily available through local shopper newspapers or Craigslist. Smaller sized (3 to 5 ton) used gravity flow wagons are much more expensive but have the added advantage of being able to be hauled short distances by a pickup truck or tractor to pick up grain. Their capacity can be increased by adding on homemade wooden extenders. Metal extenders and covers can often be purchased at local tractor supply stores. You can also build cement block or wooded bins. Grain mixers, refrigerated truck beds, and conventional freestanding plastic or metal grain hoppers are other alternatives. Delivery trucks will need to be equipped with a blower or you'll need your own augur in order to load grain into hoppers. Hoppers can be purchased with either a slide door or augur bottom depending upon how the grain is fed. Another option is to build wooden hoppers and contract with local metal fabricators to make the cone and slide door sections.

Keep in mind that feeding forages and concentrates are routine chores that can contribute significantly to the labor demands on a farm. In determining where to locate your concentrate and/or forage storage, try to time the traffic flow for different possible options and choose locations with ready access from storage to feeders.

Conclusion

There are several methods to keep feed costs down in meat goat herds. Feed costs can be decreased by optimizing the amount of forage used as compared to concentrates. When deciding on breeding strategies, be sure to account for seasonal differences in feed costs and availability.

Dividing the herd into management groups based on nutritional needs reduces the cost of feed by targeting concentrates and better quality forages to the groups with the greatest nutritional requirements. Managing the herd in groups also permits the use of different feed handling methods for different groups. Purchasing feed in bulk or through direct channels may more reduce feed costs depending on facility and space limitations.

Resources

<http://counties.cce.cornell.edu/washington/ag/Haymanual/> - Hay Productions Resources for New York State and Similar Climates – edited by Aaron Gabriel, Cornell Cooperative Extension of Washington County – *despite its name this resource contains lots of information on baleage as well as hay.*

<http://www.forages.org/forage.asp> - includes links to several important pasture resources including the Prescribed Grazing Management Manual for NYS and Forage Species Selection in NYS

<http://agebb.missouri.edu/dairy/byprod/bplist.asp> - By-Product Feed Price Listing maintained by University of Missouri Extension.

http://attra.ncat.org/attra-pub/livestock_feed/ - list of organic feed suppliers

<http://www.cfd.coop/> - Co-operative Feed Dealers, Inc. – *one of many companies selling feed ingredients, mixes & supplements.*

<http://www.pipevet.com/> - Pipestone Veterinary Supply's list of nutritional products – *one of many livestock supply companies you can order from on the web or through dealers.*

Appendix 1 – Formulating diets

One of the first steps in formulating a concentrate diet is to know the nutritional value of the available forages. Various businesses such as the Dairy One Forage Lab, 730 Warren Rd. Ithaca, NY 14850 (800-496-3344 or <http://www.dairyone.com/Forage/services/Forage/forage.htm>) offer feed analyses services. Check with the company you use to find out what analyses they recommend, the sample size (weight) required, number of mini-samples to pool for the sample, and whether fresh forage (i.e. pasture) samples need to be frozen.

The most current nutritional requirements for goats are available through the 2007 National Research Council publication, “Nutrient Requirements of Small Ruminants”. This book is available from libraries or the National Academies Press website at http://books.nap.edu/catalog.php?record_id=11654#toc (for purchase or on-line reading). The table in the book that covers “Nutrient Requirements of Meat and Milk Goats for Maintenance, Gestation and Lactation” can be accessed for free at <http://books.nap.edu/html/ruminants/errata.pdf>.

Tables for the 1982 NRC requirements for goats are on the web at <http://www.ansci.cornell.edu/goats/nutrition.html>. This webpage also includes several articles on how to formulate diets. It includes articles comparing sample goat diets to the 1992 NRC Requirements or to requirements based upon work done in the eighties at Cornell University. It also has tutorials to help use online programs to formulate diets.

There are several programs to design diets for goats available via the web. The Institute for Goat Research’s Nutrition Calculator - Goat Producer Version is available for free interactive use on the web at http://www2.luresext.edu/goats/research/nutr_calc.htm. The Cornell University Sheep Program offers a feed formulation program. It can also be used to check diets for adequate fermentable fiber. The program is called FeedForm and is available for free download at <http://www.sheep.cornell.edu/management/economics/cspsoftware/feedform/index.html>.

Keep in mind that the nutrient requirements listed for lactating meat goats sometimes assume very low weight gains for kids. In the NE US, viable meat goat enterprises may require average weight

gains per nursing kid to be in the neighborhood of $\frac{1}{2}$ lb daily. Therefore, use feed requirements for dairy does giving ≥ 3 quarts (~ 3 kg) of milk daily or ewes nursing triplets to come up with realistic requirements to support highly productive kid weight gains.

Very broad crude protein (CP) recommendations can be gleaned from a quick look at various published feed requirements for goats. These recommendations range from about 7 to 8% CP for dry does with the higher level being suggested for breeding time. The percentage of CP required increases once does are pregnant up to about 11 to 13% in late pregnancy and 12 to 14% for lactation. According to the newest NRC requirements, recently weaned doe kids weighing 44 lb need about 18 to 21% crude protein to grow 0.22 to 0.44 lb per day, respectively, while young growing doelings weighing 66 lb need 12% to 14% CP to grow 0.22 to 0.44 lb daily, respectively. Crude protein is expressed as a percentage of dry matter in these examples so consider the dry matter content of your feeds to adjust the percentage of crude protein needed to an “as-fed” level.

Appendix II – Directory of feed mills**Pennsylvania-****ADM Alliance Nutrition**

Contact: Dean Schuelke
2000 Hummel Ave.
Camphill, PA 17011
P: 717-495-5455
d.schuelke@comcast.net
Cumberland County

Cornell Bros.

1 Mill St.
Middlebury Center, PA 16935
P: 570-376-2471 or 800-326-9822
Tioga County

Fertrell Company

Contact: Jeff Mattox
PO Box 265
Bainbridge, PA 17502
P: 717-367-1566
jeffmattocks@fertrell.com
Lancaster County

Organic Unlimited

PO Box 238
Atglen, PA 19310
P: 610-593-2995
information@organicunlimited.com
Chester County

Vermont –**Morrison's Custom Feeds, Inc.**

1140 Old County Rd.
Barnet, VT 05821
P: 802-633-4387
www.morrisonsfeeds.com/mill
Caledonia County

Poulin Grain

Contact: Doug Donovan
24 Railroad Square
New Port, Vermont 05855
DDonovan@poulingrain.com
Orleans County

Whitman's Feed Store

Box 123 Greenwich St.
North Bennington, VT 05257
P: 802-442-2851 or 800-521-2705
Bennington County

New York –**Birkett Mills – Buckwheat and wheat middlings**

Contact: Don
163 Main St.
Penn Yan, NY 14527
P: 315-536-2349
Yates County

Blue Seal Feeds - Bainbridge

Contact: John Balbian
161 Jennison Lane
Bainbridge, NY 13733
P: 607-967-2641 or 800-451-9863
Chenango County

Blue Seal Feeds – Arcade

Contact: John Winchell
50 William St.
Arcade, NY 14009
P: 585-735-5100 or 800-648-1450
Wyoming County

Blue Seal Feeds – Watertown

200 Willow St.
Watertown, NY 13601
P: 315-788-0030
Jefferson County

Breezy Hollow

Contact: Ben Gaines
Hoosick, NY
Rensselaer County

Brown's Feed, Inc.

Contact: Bill
124 Orchard St.
Frankfort, NY 13340
P: 315-894-5021 or 800-564-5021
Herkimer County

Bruno's Custom Feeds

Contact: Steve Bruno
Hudson, NY
P: 518-929-2996
Columbia County

Cargill Inc. – Alexander

3540 Railroad Ave.
Alexander, NY 14005
P: 585-591-2100
Genesee County

Cargill, Inc. – Liverpool

7700 Maltage Dr.
Liverpool, NY 13090
P: 315-622-3533
Onondaga County

Central New York Feeds, Inc.

Contact: Chip Hyde
7830 Plainville Road
Plainville, NY 13137
P: 315-689-6384
mail@plainvillefarms.com
Onondaga County

Cochecton Mills, Inc.

30 Depot Rd.
Cochecton, NY 12726
P: 845-932-8282 or 570-224-4144
Sullivan County

Cold Springs Farm – Organic grain and mixes

Contact: Sumner Watson
379 Slate Hill Rd.
Sharon Springs, NY 13459
P: 518-234-8320
csfarm@capital.net
Schoharie County

Gramco Inc

Contact: Robert D Mattison
PO Box 68, 299 Waverly St
Springville, NY 14141
716-592-2845
gramcoinc@verizon.net
Erie County

Hewitt Bros., Inc.

Contact: Gordon L. Hewitt
PO Box 147
Locke, NY 13092
P: 315-497-0900
F: 315-497-9260
Hewitt@baldcom.net
Cayuga County

Hoosac Valley Farmers Exchange

Contact: John Haliford
212 S. Main St.
Schaghticoke, NY 12154
P: 518-753-6911
Rensselaer County

Keystone Mills

1975 State Rt. 336
Romulus, NY 14541
P: 315-549-8226
Seneca County

Lakeview Organic Grains

Contact: Daniel Hoover
Box 361, 119 Hamilton Place
Penn Yan, NY 14527
P: 315-531-1038
Yates County

Lightning Tree Farm - organic

Contact: Altron Earnhardt
132 Andrew Haight Rd.
Millsbrook, NY 12545
P: 914-677-9507 or 845-677-9507
Dutchess County

Mazourek Farms

105 Mazourek Rd.
Newfield, NY 14867
P: 607-564-3485
Tompkins County

McDowell & Walker – Afton Branch

P.O. Box 338
11 Mill St.
Afton, N.Y. 13730-0388
P: 607- 639 2331
sued@mcdowellwalker.com
also stores in Delhi & Sidney, mill is at Afton
Chenango County

The Ortensi Farm – organic grains and forage

Contact ; Greg or Benji Ortensi
741 Chyle Rd.
Richfield Springs, NY 13439
P: 315-858-2634
bernijortensi@aol.com
Otsego County

Richer Feeds – all 3 branches are now owned by Blue Seal**Richer - Sangerfield Branch**

Contact: Andrew Dugan
PO Box 127, 7593 Route 20
Sangerfield, NY 13455
P: 315-841-4167 or 800-228-2709
andy@ilricher.com
Oneida County

Richer - Central Bridge Branch

Contact: John Balbian
151 S. Main St.
Central Bridge, NY
P: 518-868-2045 or 518-366-1477
Schoharie County

Richer - Adams Center Branch

Contact: Glenn Waffle
18170 St. Rt. 177
Adams Center, NY 13606
P: 800-762-3277 or 315-725-2842
Jefferson County

Round House Mill, Inc.

Contact: Dana Brown
41 Elm Street
Cortland, NY 13045
P: 607-753-8204
F: 607-753-1883
dana@roundhousemill.com
Cortland County

Shur-Gain

10600 State Route 371
Cohocton, NY 14826
P: 585-384-5214
Steuben County

Swanson Farms – Corn, soybeans

Contact: John Swanson
Rt 96A
Interlaken, NY 14847
P: 607-532-8365
Seneca County

Tully Ag Center

Contact: William Dowling, CCA
20 Onondaga St.
Tully, NY 13159
P: 315-696-6400 (office) or 315-952-9364 (mobile)
F: 315-696-6008
bill@tully-ag.com
Onondaga County

MJ Ward & Son

9 Cameron Sutton St.
Bath, NY 14810
P: 607-776-3351
Steuben County

Ward & Van Scoy, Inc.

Contact: Michael Ward
PO Box 359
Owego, NY 13827
P: 607-687-2712
F: 607-687-2713
sarvansc@clarityconnect.com
Tioga County

Western New York Energy, LLC – distillers grain

Contact: Andrew Buck
PO Box 191, 4141 Bates Rd.
Medina, NY 14103
P: 315-247-1286
Orleans County

Appendix III– Sample diets

Diet 1 – CornellSF07 – Assumes hay or pasture is fed free choice, designed as a creep feed or for young, growing weaned stock

Ingredients	Pounds As Fed	% As Fed
Corn grain (cracked)	882	44.10
Soybean meal	516	25.80
Soy hulls	480	24.00
Molasses (add last) ^a	80	4.00
Vitamin-mineral premix ^b	20	1.00
Calcium carbonate	16	0.80
CSF vitamin E premix ^c	5	0.25
Deccox, 6% concentrate ^d	1	0.05
Totals	2000	100.00

90.4% dry matter, 20% crude protein, 23.6% Neutral Detergent Fiber (NDF), 19% Fermentable NDF, 2.8% Ether Extract (EE, i.e. fat), 0.59% calcium, 0.35% phosphorous

^aMolasses is included to reduce the dust. Alternatively, vegetable oil, which often can be obtained at no cost as used product from restaurants that make french-fries, can be used in place of molasses. However, water can be substituted instead and has been shown to be more effective than either molasses or oil but must be limited to no more than 5% of the mix and added immediately before feeding out.

^bThis premix is formulated by The Old Mill (800-945-4474) and distributed by Hewitt Bros. in Locke, NY. Alternatively an alternative premix can be used that meets the specific dietary needs of your animals. This premix is 50% salt, 5% of a Deccox 6% premix and then contains a filler and additional Vit A, D and E and Cobalt, Manganese, Molybdenum, and Selenium. Additional Copper should probably be added for goats.

^cContains 19,075 ppm (DM basis) and 17,011 ppm (air dry basis) of vitamin E.

^dIn addition to the Deccox in the premix to ensure that sucklings consume sufficient amounts.

Diet 2 – CornellSF09 – this diet is formulated for growing, weaned animals, 88% dry matter, 16.7% crude protein, 23.2% NDF, 19% Fermentable NDF, 3.2% EE, 0.87% calcium, 0.42%phosphorous

Ingredient	Pounds As Fed	% As Fed
Corn grain	1050	52.48
Wheat midds	300	15
Soybean hulls	300	15
Soybean meal	180	9
Water (add last) ^a	100	5
Calcium carbonate	30	1.5
Mineral-vitamin premix	20	1.0
Ammonium chloride ^b	15	0.75
CSF vitamin E premix ^c	5	0.25
Deccox, 6% concentrated ^d	0.4	0.02
Totals	2000	100.0

^aWater is included to reduce the dust and prevent lamb pneumonia. This has been shown to be more effective than either molasses or vegetable oil. The added water makes the diet about 13% moisture. It could mold in warm weather when it must be consumed within a week after adding water.

^bAmmonium chloride can be partially replaced with filler [perhaps to 25% of the supplement (0.5% of the diet)] or – if the diet will not be fed to males for a long period of time – completely replaced with corn. Ammonium chloride is not needed for does and should be included with caution in diets for young stock without fully-developed rumens

^cContains 8141 IU/lb (DM basis) or 7425 IU/lb (air dry basis) of vitamin E. This is in addition to the vitamin E in the premix, to meet the added requirements for lambs.

^dIn addition to the Deccox in the premix to ensure that lambs consume sufficient amounts.

The following two pellet mixes are designed to be added to whole corn as a grain supplement for goats eating pasture or hay free choice. The ratio of wheat midds to dried distillers grain to soy hulls can be readjusted within the confines of the two examples shown here depending on the price of each ingredient. However, the amount of wheat midds needs to be kept at 20% or more. Otherwise, the pellets will not hold together well. The pellets are designed to be fed with corn at the rate of 50% corn to 50% pellets on up to 70% corn to 30% pellets. The percentage of fermentable NDF and crude protein in the diet will drop as the percentage of corn is increased. Thus, the diet of half corn/half pellet is better suited to supplementing does nursing kids and growing kids than is the 70% corn/30% pellet mix. Both diets assume that animals are being supplied with a loose trace mineral salt in addition to the salt, minerals and vitamins in the mix. Check with your nutritionist as to what Vitamin Mineral Premix can be used in the mix to meet the needs of your animals. The coccidiostat used in these two examples is rumensin which is deadly to horses. Check with your nutritionists for recommendations as to coccidiostat use.

Diet 3-BF1Pellet – assumes that a source of loose salt is also being offered and forage is available free choice. Pellet is 90.8% dry matter, 17.4% crude protein, 47.2% NDF, 41.8% Fermentable NDF, 3.17% EE, 2.0% calcium, 0.74% phosphorous. When fed as a 50/50 mix with whole corn, the mix provides 90.4% dry matter, 13.8% crude protein, 28.3% NDF, 24% Fermentable NDF, 3.6% EE, 1.02% calcium, 0.52% phosphorous. If the amount of soy hulls in the pellet was reduced to 20% as fed and the amount of distillers grain was increased to 20%, the diet might cost more but the pellet would contain about 18.8% crude protein, and 4% EE.

Ingredients	Pounds As Fed	% As Fed	% DM
Soy Hulls	600	30	30
Wheat Middlings	1061	53	52.45
Distillers Grains	202	10	10
Calcium Carbonate	80	4.0	4.4
Ammonium Chloride	27	1.36	1.5
Salt	18.2	.9	1
VitMinPremix	11.5	.57	.6
Rumensin 80	1	.05	.05
	2000	100.00	

Diet 4 – BF2Pellet - assumes that a source of loose salt is also being offered and that forage is available free choice. Pellet is 90.8% dry matter, 21.9% crude protein, 48% NDF, 43.3% Fermentable NDF, 6.25% EE, 2.0% calcium, 0.7% phosphorous. When fed as a 50/50 mix with whole corn, the mix supplies approximately 90.4% dry matter, 16% crude protein, 28.7% NDF, 24% Fermentable NDF, 5.1% EE, 1.02% calcium, .51% phosphorous. When fed as 70% corn and 30% pellets, the mix provides 90.2% dry matter, 13.6% crude protein, 20.7% NDF, 17.2% Fermentable NDF, 4.7% EE, 0.63% calcium, 0.42% phosphorous.

Ingredients	Pounds As Fed	% As Fed	% DM
Soy Hulls	400	20	20
Wheat Middlings	404	20.2	20
Distillers Grains	1058	52.9	52.45
Calcium Carbonate	80	4.0	4.4
Ammonium Chloride	27	1.36	1.5
Salt	18.2	.9	1
VitMinPremix	11.5	.576	.6
Rumensin 80	1	.05	.05
	2000	100.00	

The following set of grain mixes were provided by meat goat producers with help from their nutritionists and have been used successfully on several farms. Your mill may need to adjust them to meet your specific requirements.

Diet 5– Bloomer1 – Uses deccox as a coccidiostat.

Ingredients	Pounds As Fed	% As Fed
Soy Hulls	510	25.5
Soy 48%	295	14.8
Wheat Middlings	475	23.8
Corn Meal	300	15
Distillers Grains	160	7
Gluten Feed	100	5
Molasses	46	2.3
Iodized Salt	40	2
Limestone	40	2
Ammonium Chloride	20	1
Deccox	13	.625
Selenium 0.06%	0	.025
R-H Mini Fortified Vitamins	0	.025
Vitamin E-20	0	.025
Flavorizer	0	.025
Total quantity	2000	

90% dry matter, 22% crude protein, 36% NDF, 31% Fermentable NDF, 3.2% EE, 1.07% calcium, 0.57% phosphorous

Diet 6 – Bloomer2 - Formulated for lactating meat does with access to forage, contains no ammonium chloride. 90% dry matter, 18% crude protein, 41.5% NDF, 32.3% Fermentable NDF, 3.5% EE, 0.86% calcium, 0.66% phosphorous

Ingredients	Pounds As Fed	% As Fed
Soy Hulls	510	25.5
Wheat Middlings	655	32.8
Corn Meal	365	18.3
Soy 48%	160	8.0
Distillers Grains	100	5
Gluten Feed	100	5
Molasses	48	2.4
Salt	20	1
Limestone	30	1.5
Bovatec9000	9	.45
Selenium .06%	0	.025
R-H Mini Fortified Vitamins	1	.05
Vitamin E-20	1	.05
	2000	

Diet 7 – GIW1 - This diet is designed to supplement the diets of weaned kids controlling invasive plants in the woods at the rate of about 2.5 percent of their body weight per day.

Ingredients	Pounds As Fed	% as Fed
Barley	2476	58.95
Soy Hulls	797	18.98
Soybean Meal	557	13.26
Limestone	54.4	1.30
Mineral Mix	18.1	0.43
Ammonium Chloride	9.1	0.22
Vitamin Pack	4.5	0.11
Deccox	4	0.10
Vegetable Oil	80	1.90
Chopped Alfalfa/Grass Hay	200	4.76
Total	4200	100

90% dry matter, 17.4% crude protein, 28.4% NDF, 22% Fermentable NDF, 3.9% EE, 0.84% calcium, 0.37% phosphorous

Diet 8– DH1Pellet- assumes hay or pasture is fed free choice.

Ingredients	Pounds As Fed	% As Fed
Corn Meal Fine	770.33	38.52
Soybean roasted	567	28.35
Wheat middlings	300	15.00
Oats crimped -loc	200	10.00
Mol70	87	4.35
Limestone 37%	30	1.50
Salt	18	0.90
Anh Am Chlor	13	0.65
MonoCalcium Phosphate	5	0.25
Magox 54%	4	0.20
Deccox 6%	1	0.05
Selenium 0.06%	2	0.10
Dairy Trace Mineral II	1	0.05
Magnesium Sulfate	1	0.05
Vit ADE 3X	0.67	0.03
Total	2000	100.00

88% dry matter, 18.6% crude protein, 18.5% NDF, 13.5% Fermentable NDF, 7.5% EE, 0.8% calcium, 0.5% phosphorous