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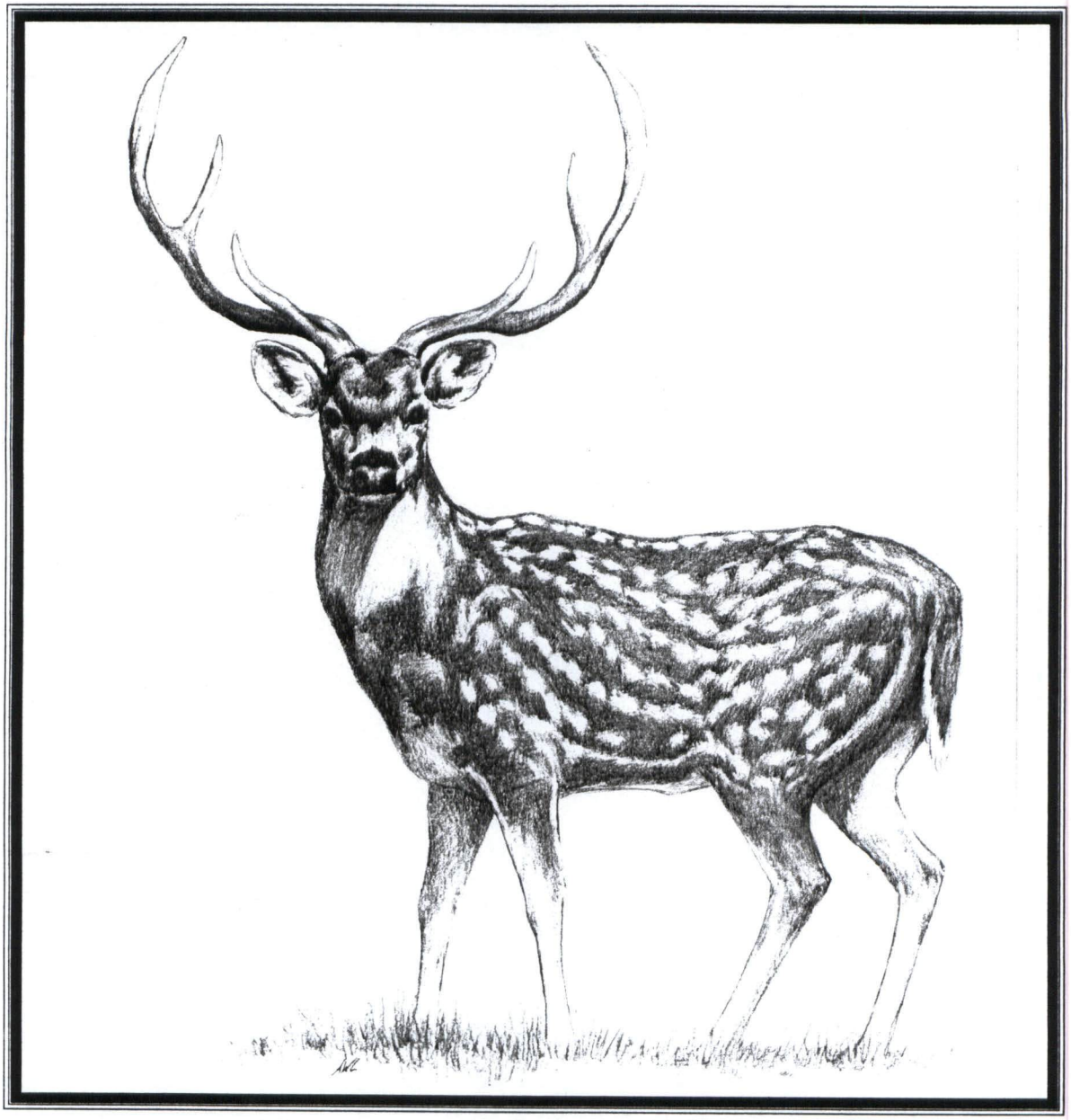
Non-Native Deer Farming Symposium



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CHAPTER 4

DEER NUTRITION

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First, deer are not cows, and they are not sheep. Deer farmers who feed their deer the same rations they feed their cattle and sheep will find that the deer simply do not gain as well. The reason is that deer have smaller rumens and shorter digestive tracts (per unit body weight) than their bovine and ovine counterparts. Thus feed passes through the cervid's gut faster and gets digested less well. In general, deer need higher quality nutrition than do other domestic animals.

What do we know about deer nutrition? We know that like other wild and domestic animals, deer have no specific requirement for a particular food - like corn or alfalfa or acorns. They do have requirements for nutrients contained within those and other potential deer foods.

The nutrients of concern are water, protein, carbohydrates (starch, sugar, and soluble and insoluble fiber), lipids (fats and oils), minerals, vitamins, and of course, energy. In order to ensure that our deer herd has an adequate diet, we need to know the nutrient requirements of deer, how much food is available, and the nutrient content of that food.

Unfortunately, nutrition is not an exact science. Probably no other species of wildlife have been studied as much as the white-tailed deer, and yet we still know very little about their nutrient requirements. We do know their requirements vary depending on (1) whether they are male or female, (2) whether they are fawns, yearlings or adults, (3) whether they are growing, (4) the season of the year, (5) environmental factors such as extreme heat or cold, and (6) their physiological state, such as pregnancy, lactation, or antler growth.

Of course we don't farm white-tailed deer. Unfortunately, we know very little about the nutrition of other species of deer, especially in captivity. The exception is the red deer, and most of the information we have on the nutrient requirements of that species is from New Zealand, where the seasons are reversed from the U.S. and pastures consist of temperate forages.

We know that deer vary in their feeding habits and nutritional requirements. White-tails, mule deer, moose and roe deer are concentrate selectors, with relatively small rumens for their body size. They are not very adaptable in the wild, and are browsers rather than grazers. Thus they are not particularly useful as a domesticated species. Most deer, such as red deer, axis, fallow, elk, barashingha, sambar, Pere

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David's, reindeer and caribou are intermediate feeders, also known as opportunistic, adaptable or selective feeders. They can survive by browsing or grazing. But none of the deer species are true grazers, like domestic cattle and sheep (Hofmann, 1985).

Since we know the most about white-tails, I'll use that data for the purposes of this paper. From a practical standpoint, if a deer farmer shoots for meeting the nutritional requirements of his exotics at somewhere between the requirements of white-tails and domestic sheep or goats, and adjusts for size, he will at least be in the ball park.

Water

Water is the most critical of all nutrients. About 70% to 75% of a deer or human's body is water. Studies have shown that deer can survive about a month with little or no feed, but animals have been known to die in as little as three days without water. My own work has shown that deer will lose weight and go off feed with even a moderate restriction in water (Lautier et al. 1988).

Deer get water from three sources: (1) free water, such as ponds, streams, and the dew on plants, (2) preformed water, or that contained in plants, and (3) metabolic water produced in the animal's cells as part of metabolism. Deer are believed to need about 3 to 6 quarts of water a day, depending on the outside temperature (Brown 1985). It is possible, but we are not sure, that with lush forage available, deer may not need free water at all. Farmed deer should be provided fresh water just as you would do for domestic livestock.

Protein

Protein makes up the building blocks of animal tissue. The building blocks of protein are called amino acids. Protein is needed for normal maintenance, such as blood, hair, and body cell replacement, growth, reproduction, and lactation. Even antler growth requires protein, since the velvet antler, before it mineralizes, is made almost entirely of a protein called collagen.

The protein requirement of weaned white-tailed deer fawns is believed to be about 13 - 20%, possibly even higher (Ullrey et al. 1967). Adult white-tails have fairly low maintenance requirements, as low as 4% for maintenance and 10% for growth (Aseleson et al. 1996), although 16% is a good all-around number for farmed red deer and others (Haigh and Hudson 1993). Wild deer can get by with very little protein, or food at all, in the winter. Pregnancy increases requirements, but not that much, particularly in the first two trimesters. In fact, the average white-tail fawn at birth contains only 525 grams of protein, and that is produced over a 6-month gestation period (Robbins and Moen 1975).

Lactation places the greatest demands on a deer for protein. The milk of white-tailed deer averages 8.2% protein on a wet basis or 36.4% on a dry matter basis (Oftedal 1981). Does lacking in protein during lactation will probably not produce a poorer quality milk, but simply less milk. Does with

twins obviously have an even higher requirement, again probably around 18% in the diet. Deer species vary a lot in the composition of their milk. When bottle-raising fawns, I suggest using diluted condensed milk, goat milk replacer, or, best of all, straight goat milk.

In bucks, even hardened antlers are about 45% protein. We know that body growth takes precedence over antler growth, so if protein is in short supply, the deer will have smaller antlers. In general, we believe a diet of 13 - 16% protein is optimum for antler development. Deer farmers producing velvet antlers for sale will want to insure an adequate diet for that purpose; those interested in meat production only should not be concerned about the nutritional requirements for antler growth, except that it is a drain on the deer's resources.

Carbohydrates

Actually, no animal has a specific requirement for carbohydrates. The soluble carbohydrates, the starches and sugars, are the major source of energy for nearly all herbivores (plant-eating animals) and omnivorous (plant and meat eaters), such as we humans. Since the deer is a ruminant (a cud-chewer), like a cow or sheep, it can digest fiber, better known as cellulose. Since deer are mostly browsing animals, their natural diets contain forbs, grasses, some berries, and brush. In short, they eat little starch, but a lot of fiber.

Fiber is useful to deer not only for energy, but for keeping the rumen healthy. Just like diary cattle, deer need a fibrous diet, and could not exist for long on solely a concentrate ration. This is important when we feed or supplement captive deer. A deer getting into a pile of corn could go into a toxic acidosis, just like any other ruminant. Supplemental feeds should be pelleted, mixed-grain, high fiber rations. I recommend 13 - 15% fiber as a minimum. Most dairy rations are adequate in fiber.

Lipids

Lipids are quite simply defined as fats, if they are solid at room temperature, or oils if they are liquid at room temperature. Deer have no specific requirements for lipids, but the fats and oils in their diets do provide an important source of energy. In fact, lipids have 2 1/2 times the amount of energy per gram as do proteins or carbohydrates. Thus the oils in foods like acorns are important to wild deer as an energy source. White-tail deer milk is 7.7% fat, nearly double that of cow's milk (Oftedal 1981).

Deer, of course, gain fat during the summer and fall to prepare for winter. But they do not need fat in the diet to do that. They convert the energy in carbohydrates to saturated adipose fat, then draw on that during hard times. This is a natural phenomenon, and one of the reasons the nutrient requirements and feed intake of deer in the winter is so low. Adipose, or depot fat, is readily available for conversion to energy when needed, and the fat in the muscle, known as marbling, is very low in deer.

This seasonality of deer species is a problem for the deer farm manager. Carcasses are too fat

during some seasons and too lean during others. You can take advantage of the fact that nutrient requirements are low in the winter and save money on feed - but also be careful not to overfeed and let the animals get fat in the spring and summer. Some species, such as axis, seem to have less seasonality than other species.

Minerals

You would think we would know a great deal about the mineral requirements of deer. Unfortunately, due to the difficulties of working with wild animals, and the lack of adequate facilities and large numbers of deer required for this work, our knowledge of deer mineral requirements is sketchy.

The total mineral content of a deer's body is only about 5%. The major minerals we are concerned about are calcium and phosphorus. These are obviously needed for bone and antler growth, but also for milk production, blood clotting, muscle contraction, and general metabolism.

Hardened deer antlers are about 22% calcium and 11% phosphorus. The many studies of the mineral requirements for antler growth have yielded conflicting results, partly due to a small number of deer in the studies, and partly due to the overriding influence of genetics on antler growth. Early studies (French et al. 1956) indicated that .09% Ca and .27% P were the minimum required for antler growth. A later study showed a diet of .64% Ca and .56% P were necessary for antler growth (McEwen et al. 1957). Bob Cowan and Bill Long of Penn State later found that .20% phosphorus was adequate. Harry Jacobson (1984) at MSU suggested P levels as low as 0.14 - 0.29% were adequate. Duane Ullrey (1988) at Michigan State has found that .45% Ca and .30% P are optimal for fawns. Most recently, Grasman and Hellgren (1993) found that P requirements of deer varied between .12% and .16% seasonally.

One of the reasons these mineral levels seem so low, and may be so variable, is the fact that bucks can store minerals in their skeletons, and transfer them to the antler when needed. In fact, during antler mineralization, male deer undergo an "osteoporosis", or removal of minerals from their bones, similar to that which happens in elderly women. The difference, of course, is that after the antlers harden, the minerals lost from the bones are replaced from the diet.

Unfortunately, we know even less about the deer's possible requirements for other macro- or micro-minerals. Deer may need sodium, as they will often use salt licks. We don't know if this is because they are lacking this mineral, or perhaps it just tastes good. In some areas of the country, selenium deficiencies, which lead to a condition known as white muscle disease, have been suspected. Hungarian and New Zealand deer farmers often supplement copper in red deer rations (Sugar et al. 1991). We really have no information at all on the need for other trace elements. Feeding trace-mineralized salt in the ration or free-choice should cover your trace-mineral needs.

Vitamins

Our knowledge of deer vitamin requirements is also pretty sketchy. Vitamins are classified as either fat soluble (A, D, K, and E) or water soluble (C and B complex). Fat soluble vitamins are stored in the body, and can, in some cases, become toxic. Water soluble vitamins are not stored and are needed by most animals on a daily basis. Fortunately for the deer, the microorganisms in the rumen (bacteria and protozoa) produce all the vitamin K and B complex the deer needs. Ruminants also have no need for vitamin C.

Vitamin A is converted from a compound in plants called carotene. Deficiencies of vitamin A have been reported in wild deer (Youatt et al., 1976). Deficiencies can lead to blindness and poor reproduction. Unfortunately, we really don't know what the vitamin A requirements of deer might be.

There has been some work done on vitamin D. One of my students found that circulating levels of vitamin D in the blood varied with the antler growth cycle in bucks (Van deer Eems et al. 1988). That makes sense because vitamin D is needed for calcium absorption and metabolism in all animals. We do not know the requirement for vitamin D in deer, and there has not been reports of vitamin D deficiency symptoms in deer.

Energy

Oddly enough, energy is not really a nutrient. It is a property of other nutrients. Protein, lipids and carbohydrates have energy, whereas water, vitamins and minerals do not. Energy is usually expressed in terms of calories (c), or kilocalories (Kcal). Some cattlemen may be familiar with the TDN system (Total Digestible Nutrients), where energy is expressed as a percent of the diet or pounds per day.

Energy is probably the most variable of the requirements, because it is so dramatically affected by the environment. Basal metabolism is defined as the amount of energy needed to maintain body temperature in a normal environment, allowing for respiration and a small amount of activity. Actual energy requirements are generally about twice maintenance. There are, of course, additional energy requirements for growth, reproduction, pregnancy, lactation, and antler growth. Just as important, there are additional requirements for daily activity such as walking and browsing, and for wild deer, avoiding predators or running from hunters or snowmobiles. Deer need substantially more energy to maintain their body temperature in cold weather, especially if they are forced to move during that time to seek food or avoid danger.

It has been estimated that the maintenance energy required by a 120 pound white-tailed doe in winter is about 3,192 Kca/day of digestible energy (Ullrey et al. 1970). Standing increases the energy costs over lying down by about 9%. Locomotion increases energy depending on the speed, surface (such as snow depth and crust), and vertical climb.

Energy - Feed Intake Relationships

An interesting thing about energy requirements is that they are not directly related to body weight. That is, as the deer gets larger, of course it needs more energy, but it actually needs less per unit body weight. This is also reflected in the deer's feed intake patterns. The larger the deer, the less it eats per unit body weight. More importantly, energy requirements and feed intake vary seasonally.

Both bucks and does eat the most in late summer and early fall. This may be the most critical time for deer. Again, this will vary by species. Bucks are growing their antlers and laying down fat for the winter rut, does are lactating or weaning their fawns, and fawns are shifting from a milk diet to solid food.

Once winter begins and the breeding season starts, both bucks and does reduce their feed intake. There minds are on the rut, and even though it and winter temperatures require more energy, they have prepared by storing fat earlier in the year. Deer can easily lose 15% to 20% of their body weight in winter, and recover with the spring greenup. This seasonality is difficult for the farmed deer manager, but expect some winter weight loss in most species.

Science versus Art

The feeding and nutrition of any livestock is guesswork at best. As the Bible says, "the eye of the shepherd fattens the lamb." Nutritional guides for domestic goats and sheep, available from the National Research Council, or from animal husbandry books or pamphlets from the Extension Service, are your best starting guides for feeding farmed deer. From there, we can find bits an pieces of information on specific deer species from the sources quoted in this article. Each species is different in its requirements and seasonality, as is each pasture in its quality. All the books and tables in the world are not nearly as important as an attentive farm manager who carefully monitors the progress of his pastures and animals.

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