HAY FOR HORSES: ALFALFA OR GRASS?

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ABSTRACT

Alfalfa hay is an excellent source of energy, protein, calcium and some other nutrients for horses. Its concentrations of protein and calcium meet the nutrient needs of horses in high levels of production, such as growth and lactation, but exceed the nutrient requirements of horses in other life stages. Controversy exists over the best use of alfalfa in horse rations. Grass hays are also popular for horses because of their lower energy, protein and calcium concentrations. Grass hay meets more closely the nutrient requirements of the largest percentage of horses, the idle horse. Tradition plays a large role in the selection of feeds for horses. Hay producers can help educate horse people about what hays are most beneficial to horses in different life stages.

Key Words: alfalfa hay, grass hay, horses, nutrient requirements

INTRODUCTION

Alfalfa hay has been both heralded and maligned as a feed for horses. Tradition holds that timothy hay and oats are the best feeds for horses, and that alfalfa and corn spell disaster. Alfalfa hay may not be the best feed for all horses in all situations, but it contains nutrients needed for many classes of horses. Grass hay falls short of meeting the nutrient requirements of high production life stages, but is an excellent filler for horses that require bulk in the diet. An understanding of the nutrient requirements of horses compared to the nutrient content of alfalfa hay or grass hay will help nutritionists, hay producers, and horse owners make informed decisions about what type of hay to feed to horses.

PROBLEMS THAT MAY (OR MAY NOT) BE ASSOCIATED WITH ALFALFA HAY FOR HORSES

There are three main points of contention among horse people regarding the feeding of alfalfa hay for horses:

1. Alfalfa hay contains too much energy.
    a. It is too rich for horses in maintenance, causing excessive weight gain. If fed in small enough amounts to prevent weight gain, horses will always feel hungry, with insufficient gut fill, and will look for other things to eat including fences and barns, hair off other horses, dirt or manure.
    b. Excess energy in the diets of growing horses can cause developmental orthopedic disease.

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2. Alfalfa hay contains too much protein.
    a. Excess protein in the diets of race or endurance horses will slow performance times.
    b. Deamination of amino acids for use for energy will increase heat increment which can increase heat stress during athletic performance
    c. Excess protein results in increased ammonia excretion in urine.
        i. Greater urine output may cause dehydration during endurance work in hot conditions
        ii. Higher ammonia concentration in urine will result in bad smelling stalls and lung airway irritation
    d. Excess protein, like excess energy has been implicated as a cause of developmental orthopedic disease in growing horses.
3. Alfalfa hay contains too much calcium and/or magnesium
    a. The high calcium level causes a high calcium:phosphorus ratio which may contribute to developmental orthopedic disease
    b. Hi magnesium levels increase the chances of the formation of enteroliths (intestinal stones).

Most of the concerns about alfalfa hay concern horses in particular life stages or physiologic states. An understanding of the nutrient needs of horses in general, and of various life stages in particular, can help place into perspective the various advantages and disadvantages of feeding alfalfa hay.

BASIC CONCEPTS OF HORSE NUTRITION

Some basic concepts of horse nutrition, across all physiologic states are these:

1. Horses eat to meet their energy needs. They also eat to meet a level of gut fill, required for digestive tract and microbe health. Horses whose energy needs are met with feeds of insufficient bulk (too energy dense) will continue to seek food to fill their digestive tract.
2. The average horse will eat about 2% of its body weight daily (1.5 to 3.0% range) of dry (as fed) feed. A horse that weighs 1100 lbs. (average 15 hand Quarter Horse) will eat about 22 lbs. of dry feed (hay) each day.
3. Horses need a forage based ration. At least 50% of the ration, or at least 1% of body weight must be consumed as forage each day (important for gut fill, for nutrition and health of large intestine microbes, as a reservoir of water in the body, and to maintain digestive tract pH).
4. Horses cannot tolerate large amounts of soluble carbohydrate (grain) in their diet. Soluble carbohydrate reaching the large intestine will be fermented rapidly by microbes, leading to massive acid production, decreased pH, microbial death, toxin production, and possible, endotoxemia, colic and laminitis. The high nutrient requirements of working, lactating and growing horses requires that a substantial nutritional requirement, particularly energy, be met by good quality forage.
5. Horses can survive on very low quality forage, but not in acceptable condition for most horse owners.

NUTRITION FOR DIFFERENT LIFE STAGES

Applying these basic nutrition concepts to horses in different physiologic states can provide insight into how alfalfa or grass hay may be useful as a feed for horses in these stages. The National Research Council's Nutrient Requirements of Horses (NRC, 1989) provides estimates of nutrient requirements of horses in different physiologic states (the requirements used herein are for a horse with a mature body weight of 1100 lbs which is an average weight for an average size horse.) and also nutrient content of various feeds commonly fed to horses. Full bloom alfalfa hay and oat hay are used to compare the nutrient contributions of different hays to meeting the nutrient requirements of horses in different physiologic states described below. Requirements for energy, protein, calcium and phosphorus are reviewed. Vitamins and micro-minerals are also important nutritional components of hay, but they will not be discussed in this paper.

Maintenance – the mature horse in maintenance condition is doing nothing productive (not growing, pregnant, lactating, or working). Therefore its nutrient requirements are low, even though its need for bulk in the diet is still considerable. High quality alfalfa hay will meet the nutrient requirements (energy, protein, etc.) long before the gut fill requirement is met. For these horses, a grass hay, alone or in combination with alfalfa hay, can still meet nutrient requirements, but in a higher volume of feed. Grass hays usually meet these needs, giving the horse lots to eat to fill his digestive tract and occupy his time.

Pregnancy – Nutrient requirements are not greater than maintenance until the last three months of (an 11 month) pregnancy (to meet the needs of the growing fetus). Fed *ad lib*, however, many mares gain significant amounts of weight during the second trimester, perhaps in anticipation of the nutrient drain of late gestation and lactation. A diet of full bloom alfalfa hay alone, fed to meet 100% of the energy need in the last trimester, provides 179% of the protein requirement and 290% of the calcium requirement, but only 78% of the phosphorus requirement (Figure 1). Oat hay alone meets 100% of the energy requirement with 10% more feed than alfalfa fed alone. This much oat hay provides 112% of the protein requirement, 87% of the calcium requirement and 91% of the phosphorus requirement (Figure 2). Dry matter intake is only1.8 and 2.0% of body weight in mares fed alfalfa or oat hay alone, respectively, in this physiologic state. Calcium to phosphorus ratio of the alfalfa diet is 4.9 to 1 and in the oat hay diet is 1.3:1. Both diets are deficient in phosphorus and the oat hay diet is deficient in calcium as well. Mineral supplementation is sometimes done to correct for mineral deficiency, but from a practical standpoint, it is sometimes easier and less expensive to simply feed more feed to meet marginally deficient mineral requirements.

General nutrition rules hold that the calcium to phosphorus ratio should be within a range of 1:1 to2:1. The calcium:phosphorus ratio of alfalfa hay is always higher than 2:1, sometimes as high as 6 or even 8 to 1. Some nutritionists believe that additional phosphorus (above the requirement) should be supplemented to horses fed alfalfa hay to bring the calcium:phosphorus ratio closer to 2:1, while others believe that if the phosphorus requirement is met, that excess calcium and a high calcium:phosphorus ratio can be tolerated. No clear consensus appears to be found throughout the horse industry. Frequently, nutritionists take a middle road, and allow high

calcium:phosphorus ratios in mature horses if phosphorus requirements are met, but often add supplemental phosphorus to the rations of growing horses to bring the calcium:phosphorus ratio closer to 2:1.

Lactation – Nutrient requirements are high during lactation, particularly early lactation. Neither oat nor alfalfa hay alone can meet energy requirements without comprising over 2.5% of body weight. Concentrate must be added to the diet as an energy source. For example, if one sets the forage content in the diet at 1.5% (16.5 lbs. for an 1100 lb. mare), 11.5 lbs of oats are required to meet the energy requirement of early lactation in mares fed oat hay and 10.2 of oats to meet the energy requirement in mares fed full bloom alfalfa hay. The alfalfa hay and oats combination provides 112% of protein requirement, 141% of calcium requirement and 76% of phosphorus requirement (Figure 3). The oat hay and oats combination meets 78% of protein requirement, 48% of calcium requirement and 92% of phosphorus requirement (Figure 4). Both rations are slightly deficient in phosphorus and have calcium:phosphorus ratios of .8:1 and 2.8:1 for the oat hay and alfalfa hay forage based rations, respectively. The oat hay and oats diet is deficient in protein, calcium and phosphorus, and has a calcium:phosphorus ratio below 1, while the alfalfa and oats diet exceeds requirements for protein and calcium, but is deficient in phosphorus. The alfalfa hay diet provides 151% of the lysine requirement while the oat hay diet provides only 34% of the lysine requirement. Lysine is the first limiting amino acid in most horse diets. Protein and calcium supplementation is needed for lactating mares fed oat hay based diets. Both alfalfa and oat hay fed mares may benefit from phosphorus supplementation.

Growth – The value of alfalfa hay becomes more apparent when formulating rations for growing horses. A 6-month-old weanling fed 8 lbs. of alfalfa hay and sufficient oat grain to meet energy requirements will consume 6.2 lbs. of oats. Requirements for protein, lysine, calcium and phosphorus will all be exceeded (107, 118, 158 and 119% of requirement, respectively) and the calcium: phosphorus ratio will be 2.5:1 (Figure 5). If this same weanling is fed 8 lbs. of oat hay, sufficient grain to meet energy requirement will be 6.8 lbs of grain. Requirements for phosphorus will be met (128%), but protein (77%), lysine (32%), and calcium (51%) are deficient and the calcium:phosphorus ratio is .76 (Figure 6). Supplementation of protein, lysine and calcium is definitely required for adequate growth in young horses fed rations based on oat hay in particular and grass hays in general.

Other factors besides simply meeting crude nutrient requirements must be considered with regard to alfalfa hay for growing weanlings and yearlings. Protein quality (composition and amounts of amino acids within proteins) must also be considered. Alfalfa hay is a good source of lysine, the first limiting amino acid for growth, compared to other feeds. In fact, it contains more than twice the lysine of oats. When alfalfa hay is fed to meet protein requirements, lysine requirements are usually met as well. However, nutrient availability as well as nutrient content of a feed must also be considered. Protein digested in the small intestine allows amino acids to be absorbed into the bloodstream and transported directly to the tissues of the horse where they can be utilized for growth. Protein that passes undigested through the small intestine and reaches the large intestine is digested and utilized by microbes for microbial growth rather than growth of the horse. Gibbs and Potter (2001) summarized some research on site of digestion of protein from different feeds, and stated that 69% of the protein from soybean meal is digested in the small intestine while only 21% of the protein from alfalfa hay is digested in the small intestine. They also stated that in a

ration composed of 60% oats and 40% alfalfa hay, the alfalfa provided 62% of the crude protein and 66% of the crude lysine, but only 31% of the protein digested and absorbed in the small intestine and only 33% of the lysine digested and absorbed in the small intestine. Based on crude protein and crude lysine levels, a ration of 60% oats and 40% alfalfa would meet 118 and 114% of the protein and lysine requirements, respectively. Based on small intestine protein digestion, however, the same diet would meet 104 and 95% of the protein and lysine requirements, respectively. The decreased availability of protein and lysine in this ration is due largely to the low percentage of protein from alfalfa hay that is digested and absorbed from the small intestine. This research shows that while alfalfa hay is high in crude levels of protein and lysine, its levels of digestible protein and lysine are likely less, and alfalfa hay should not be relied about entirely to meet requirements for growth. Feeds with a higher level of small intestinal digested protein, such as soybean meal, should be considered for growing horses to ensure adequacy of absorbable protein and lysine.

A discussion of alfalfa hay for growing horses should also include a consideration of the role of alfalfa hay in developmental orthopedic disease. Developmental orthopedic disease is a multi-factorial syndrome that involves abnormal development of long bones during periods of fast growth. It can be manifest in a number of ways including angular and flexural limb deformities, cysts and ulcerations of articular cartilage, and bone malformations in both the long bones of the limbs and cervical bones of the neck. The exact mechanism of these abnormalities is not known, nor is its cause. Genetics are thought to play an important role, with certain family lines showing greater percentages of foals with developmental orthopedic disease than other family lines. Nutritional causes of developmental orthopedic disease have been examined, although without consensus on the causative nutritional agents. McIlwraith (2001) presented an extensive review of the literature regarding causative factors of developmental orthopedic disease. Among the nutritional factors reviewed, McIlwraith reported that excess energy may predispose growing horses to developmental orthopedic disease, but that excess protein does not. Similarly, excess phosphorus, but not excess calcium (unless it was in combination with excess energy) or marginal phosphorus deficiency, has been shown to be associated with developmental orthopedic disease. These findings do not lead to a conclusion that alfalfa, per se, contributes to developmental orthopedic disease. Overfeeding of alfalfa hay and other feeds can lead to excess energy intake, but the high levels of protein and calcium of alfalfa hay by themselves have not been shown as individual factors in developmental orthopedic disease.

Work – Nutrient requirements for work increase in proportion to energy requirements. Energy requirements are proportional to the amount of work done. At low levels of work, energy and other nutrient requirements may be met by simply feeding more of the maintenance diet. As work intensity increases into the intense category (race horses and horses in heavy competition and training), rations may need to be reformulated to provide energy and other nutrients in a more dense concentration. The primary nutrient needed for work is energy. Excess protein, calcium and phosphorus are not needed in higher concentration than in maintenance rations, except when intake is limited by energy concentration in the diet. The NRC states that horses undergoing intense work need 11.4% crude protein, .35% calcium and .25% phosphorus. These levels are approximately equivalent to the requirement of mares in late lactation or for growth in long yearlings (18 months old). Both these physiologic states require higher concentrations of nutrients than maintenance, but not as high as for more intense production such as earlier growth

or early lactation. As such, no clear advantage can be assigned to alfalfa hay for its ability to increase protein and calcium concentration in rations. In the face of the huge energy demand for work, the slightly higher energy content of alfalfa hay compared to good quality grass hays gives alfalfa hay only a slight advantage. No matter what forage is fed, formulating rations for horses performing intense exercise is challenging.

Many horsemen believe that high protein diets are detrimental to horses. Garlinghouse (2001) elaborated on many of the disadvantages of alfalfa hay associated with its high protein content stated at the beginning of this paper. Additionally, she summarized the findings of other researchers who surveyed the rations fed at various training stables and found an inverse relationship between protein content of the diet and athletic performance, in race, three-day event, or endurance horses. Whether this relationship represents a true cause-effect relationship or is only coincidental is not known. Garlinghouse also implicated the high calcium content of alfalfa hay as a possible causative contributor to synchronous diaphragmatic flutter, a condition that often accompanies dehydration and significant electrolyte loss in endurance horses.

TRADITIONAL FEEDING PRACTICES

Trainers of horses for different events have different traditions for feeding horses. Whether they are truly beneficial, or have only the benefit of tradition, is not always known, and, of course, exceptions can be found within all training disciplines for all of these feeding regimes.

Many racehorse trainers feed copious amounts of oats in combination with free choice grass hay, and liberally add a variety of supplements. The traditional hay for racehorses is timothy. Timothy imported from out of state to California racetracks is frequently priced well over $200/ton. Its nutritional value is similar to other grass hays. Its advantage, besides its traditional use, is its palatability, even when quite mature.

Endurance horse trainers believe strongly in feeding feeds that keep blood glucose levels consistent and low. They also believe that high protein levels are detrimental, and so feed grass hays, beet pulp and vegetable oil. The oil is dense in energy, and the beet pulp is low in soluble carbohydrate. Endurance horse trainers feed grain sparingly, particularly before the start of a ride, as they fear the high blood glucose response that grains induce will lead to a glucose slump, bringing with it fatigue, before the end of the ride. The highest quality grass hays are sought, as while protein is avoided, energy content should be high because of the large energy requirement for this type of work.

Trainers of western pleasure horses aim to produce a horse with a calm disposition in the show ring. Some of these trainers believe in the concept of a “grain high”, that is, a tendency toward excitable behavior induced by the elevation of blood glucose concentration when grain is fed. Many of these trainers feed alfalfa hay for its energy content and add rice bran for its high oil and low soluble carbohydrate content.

While a great deal of attention has been paid to meeting the nutrient requirements of athletic horses, these horses make up only a minority of the entire horse population. Most horses are kept purely for pleasure and recreation. Even show horses are not trained at very intense levels,

their training mostly being to accomplish certain behaviors, movements, and gaits. The nutrient requirements for these horses are not very high compared to the elite performance horse and their need for bulk in the diet is large. A palatable grass hay or a mixture of grass and alfalfa hay with supplemental concentrates as needed will usually satisfy their needs.

ALFALFA HAY AS A CONTRIBUTOR TO ENTEROLITHS

Enteroliths are intestinal stones that form in the large intestine of some horses. For unknown reasons, enteroliths form like pearls, that is, layer after layer of mineral deposited over a central small stimulant or nidus. The layers are formed primarily of magnesium, phosphate and ammonia which precipitate out of solution into a crystalline compound called struvite. By themselves, enteroliths, which can be as much as 12 inches across, are not harmful. However, they have a tendency to move in the large intestine and can cause a fatal blockage of the intestines if they become lodged in a flexure or narrowing of the large intestine. Their cause is not known, but population studies have shown that there is a greater tendency for enteroliths to occur in Arabian horses than in other breeds. A report from the College of Veterinary Medicine at the University of California at Davis (Hassel, 2001) stated that 98% of the horses treated by U.C., Davis veterinarians were fed a diet that contained at least 50% alfalfa hay. The magnesium concentration of some alfalfa hay and its high protein content (which may increase large intestine ammonia concentrations) implicate alfalfa hay as a nutritional causative agent. Hard water and bran are also being investigated as nutritional contributors to enterolith formation. The high mineral content of hard water may be a source of magnesium, although it is estimated that the daily intake of magnesium from drinking water is less than one-tenth of that which is ingested in a daily feeding of alfalfa hay. Rice bran and wheat bran are also being investigated to determine their role in enterolith formation. Brans are high in phosphorus, protein and magnesium.

The highly digestible nature of alfalfa hay may also contribute to enterolith formation as highly digestible feeds do not stimulate intestinal motility to the same extent as poorly digestible forages such as straw. Confinement of horses to stalls may also decrease intestinal motility and enhance enterolith formation.

The incidence of enteroliths in California is on the rise. In the future, analysis for magnesium concentration may become useful information for horse nutritionists trying to prevent enteroliths. As a side note, some limited research on the refeeding of starved horses has shown that the high magnesium content of alfalfa hay is helpful as a needed mineral supplement for starving horses (Stull, 2001). The value of the magnesium content of alfalfa hay should be evaluated on a case-by-case basis.

PROBLEMS THAT MAY (OR MAY NOT) BE ASSOCIATED WITH GRASS HAY FOR HORSES

Grass hays are increasingly popular in horse diets, for the reasons above. However, grass hays have their own drawbacks.

1. Grass hay is variable in nutrient content, physical form and palatability

    a. Grass hays can accumulate high levels of nitrates
    b. There is much variation in stem size and grain content
    c. Palatability of grass hay is variable. Hay that looks good doesn't always taste good to horses and vice versa.
2. Grass hays are harder to handle and feed.
    a. Bales are sometimes loose
    b. Flakes and whole bales fall apart when feeding
    c. Stacks of cereal hay attract mice, rats, cats and snakes.
3. Grass hays are lower in energy, protein, lysine, calcium and some other nutrients.
    a. As show above, this can cause nutrient deficiencies, particularly for lactating mares and growing horses.

Grass hay serves an important role in feeding the largest class of horses, the idle horse. As mentioned above, a horse that is doing nothing productive has relatively low nutrient requirements. A palatable, filling grass hay will provide bulk in the diet and entertainment for horses that are idle and bored most days.

The importance of bulk in the diet should not be underestimated. Nutritionists spend most of their time building rations that are nutrient dense. But for the horse in maintenance, a ration that is nutrient sparse must sometimes be the goal. Horses have evolved for centuries as "nibblers", that is, a specie that spends the majority of its day eating. Studies of grazing behavior show that horses on pasture spend more than 12 hours each day eating. The digestive tract of the horse is designed to be full and to work slowly, but to also move along large amounts of fibrous feed. Highly concentrated, low bulk diets have been shown to be associated with colic, laminitis, enteroliths, ulcers and other disorders.

Grass hays are also sometimes fed to growing horses with the idea that a low nutrient diet will produce a slower rate of growth and will decrease the incidence of developmental orthopedic disease. This is a controversial practice, as while a less than maximal rate of growth may be desired, malnutrition is not; and what may be defined as conservative growth by some may be seen as starvation by others. Additionally, efforts at "paced" growth to decrease developmental bone disease may backfire if paced growth causes poor condition in colts to the extent that the manager increases nutrient content to combat this, and then produces a rapid burst of compensatory growth, which may increase the chances of developmental orthopedic disease.

Grass and alfalfa hay mixes are popular as they can combine the best qualities of each hay. Its medium energy and protein contents, its relatively high (compared to grass hay) calcium content and its lower (than alfalfa hay) calcium:phosphorus ratio can meet the needs of a variety of horses and horse owners.

HOW HORSE PEOPLE BUY HAY

If a horse eats, on average, two percent of its body weight daily, then the average 1100 pound horse will consume 22 lbs. of hay per day or 8030 lbs, or 4 tons, of hay per year. Some horsemen estimate 3.5 tons of hay per head per year with the idea that concentrate or pasture is also fed.

Of course buying hay in bulk in the summer or fall is the most economical way to buy hay, just as it is in the dairy or beef industry. However, the majority of horse owners do not own horses for a business, and many horse operations are run in a hand-to-mouth financial fashion. Storage and care of stacked hay is also problematic. Some stables simply don't have enough room, and some simply don't pay enough attention to protect hay from rain and mud.

The majority of hay is bought from the feed store, a bale at a time. Eighty percent of the horse owners in the U.S. are women, and a significant percentage of these women don't want to lift a 120 lb. bale out of their car or truck when they get home. Lighter bales are easier to handle. When hay is bought one bale at a time, the look of the bale is important. Bales that are sun bleached on one surface or have a broken string, or something else, will likely be rejected. It's not uncommon for a horse owner to bring back a partial bale that is unsatisfactory and ask for a refund.

Few horse people truly understand horse nutrition. While they may buy and feed a myriad of specialty supplements, most don't understand more basic concepts of energy, protein and macro mineral requirements. The concept of "more is better" is frequently employed when buying hay, that is, that the best hay is the greenest, finest stemmed and leafiest. However, even for the youngest foal, protein requirements never exceed 16% crude protein, so there really is no need to feed horses top quality, "dairy hay". On the contrary, for horses in maintenance, early pregnancy and light work, a poorer, bulkier, "dry cow" type hay or an alfalfa-grass mixture is likely best.

SELLING HAY TO HORSE PEOPLE

Considering the ideas presented in the section above, it is would not be surprising to find that hay producers and marketers do not wish to deal with horse people. However, the size of the horse industry should make one at least consider the possibility. Estimates of horse populations are hard to make, but there are estimated to be at least 400,000 horses in California, and some estimates put that number closer to one million. That's at least 10% of the size of the dairy industry in California.

A few facts about horse owners can perhaps shed some light on how to meet their needs for buying hay. Twenty percent of horses in the U.S. are kept for a profit-motivated activity (ie, race horses, ranch horses, some breeding stock such as Thoroughbreds and Standardbreds). Eighty percent of horses are kept for non profit-motivated activities such as showing, recreation, exercise, and for personal pleasure, similar to reasons for having a dog or a cat. Eighty percent of the horse owning public are women and 90% of the horse owning public has had at least some college education.

Most horse owners want to spend time with their horses, not shopping for hay. But they are concerned about buying a good quality hay to meet their horse's nutritional needs. If a hay seller can talk knowledgeably about a horse's nutrient requirements, not necessarily in great detail, but at least know in broad strokes the nutrient requirements of horses in the different life stages described above, this can go a long way toward building a good, trusting relationship between the horse owner and the hay seller. If the hay has been tested, the horse owner will feel like there

is proof of the nutritional value of the hay, even if the hay seller has to explain what the analysis means. As a side note, most animal nutritionists trust wet chemistry analyses (ADF, NDF, CP, minerals) more than NIR analyses.

Owners of only 1 or 2 horses will likely continue to buy hay at the feed store a bale at a time. But owners of as few as 6 or 7 horses could benefit from buying a truckload (25 tons) of a hay once a year, especially if they understand the cost savings and are taught how to properly tarp the hay to preserve it through the rainy season. Horse people appreciate the tighter squeezed stack compared to the looser hand-stacked hay as it is easier to tarp and safer to climb. Many female horse owners also would appreciate a lighter bale.

Hay sellers can increase their business with horse people by offering different types of hay, such as alfalfa hay, oat hay, bermuda or orchard or some other type of fine-stemmed hay, and a mixture of alfalfa and grass hay. A few weeds in the hay might not matter, many horse people don't recognize a weed when they see one if they are all the same color and approximately the same shape, but the hay must be free of mold and it must be uniform from bale to bale. And of course it must be palatable. Many horse owners feed their horses like they would feed their own children. If the horse isn't enthusiastic about eating its hay, the horse owner won't want it.

Hay sellers can sell their service as well as their product. Some services that horse owners may be willing to pay for include:

1. Delivery of small loads of different types of hay (in a timely manner).
2. Stacking, crowning and tarping the hay at the stable.
3. Hay storage of large purchases at the hay seller's farm, with delivery of small loads throughout the year:
    a. for stables with limited storage space
    b. for stables where personnel are unwilling to take the time to keep hay tarped and stacked appropriately to prevent rain damage.
    c. for stables where hay theft is a problem
    d. for stables that have their hay analyzed and a concentrate formulated to complement the nutrient content of the hay. Purchases of large amounts of hay require re-testing of hay and reformulating of rations less frequently.

Developing hays for special nutritional needs of horses may be a bit far-fetched, but maybe can fill a niche market. For example, maybe low magnesium alfalfa hay can be found and sold for horses that have had an enterolith removed. The cost of the enterolith surgery will make even expensive hay look like a good preventative measure. On the other hand, high magnesium hay may be purchased by horse rescue groups for feeding starved horses. Horses with muscle problems such as "tying up" and mares with a history of retained placenta are often given selenium supplementation. Maybe high selenium hay could be marketed to provide the selenium every day in a more "natural" form. Other specialty hays may also be developed. Alfalfa hay is already a special "low carbohydrate" hay, which is good for horses prone to laminitis, it just have never been marketed as such.

There is a trend, I believe, toward feeding more grass hay to horses. Alfalfa hay has been available for so long that people in California take it for granted. The bad press on alfalfa hay, as

discussed above, is out there, and the science of feeding horses and meeting nutrient requirements for horses with high protein and calcium requirements isn't very exciting. I think there is a market for very high quality grass hays, that is, hay that is palatable, fine-stemmed, and attractively baled. I think there is a very good market for grass-alfalfa mixes. It still brings the good nutrition of alfalfa hay, but in a watered down concentration, which is lower in protein and brings the calcium:phosphorus ratio to a more reasonable number, and is usually quite palatable.

Horse owners generally discover hay sellers by word of mouth. Advertising in horse magazines, promoting service and convenience as well as quality hay, can spread the word further. Networking with feed store owners and veterinarians can also help promote a hay seller, as, for better or worse, this is where many horse people get their information about horse nutrition and feed purchasing. Making a list of horse owners in an area and calling them when new hay becomes available, or when someone in their area will be receiving hay, may increase sales of relatively small amounts of hay that can be delivered all at one time. And when the horse owner calls, the hay seller can help educate the horse owner not just about what the horse owner wants, but what the owner's horse really needs. People appreciate well-meaning guidance.

The extra effort taken to network with horse owners and associated businesses, supply different types of hay, deliver small loads, provide other convenience services, and educate horse owners should not come without a cost. While a call to a hay seller for horse hay should not elicit a higher price than a call for equivalent hay for heifers, most horse owners realize that quality product and service have a value. Eighty percent of horses are owned by people who do not keep horses for their profit making potential, and most are willing to pay the cost of their horse addiction. Ninety percent of horse owners have acquired at least some college education, so educating them about the best way to buy and feed hay should be possible.

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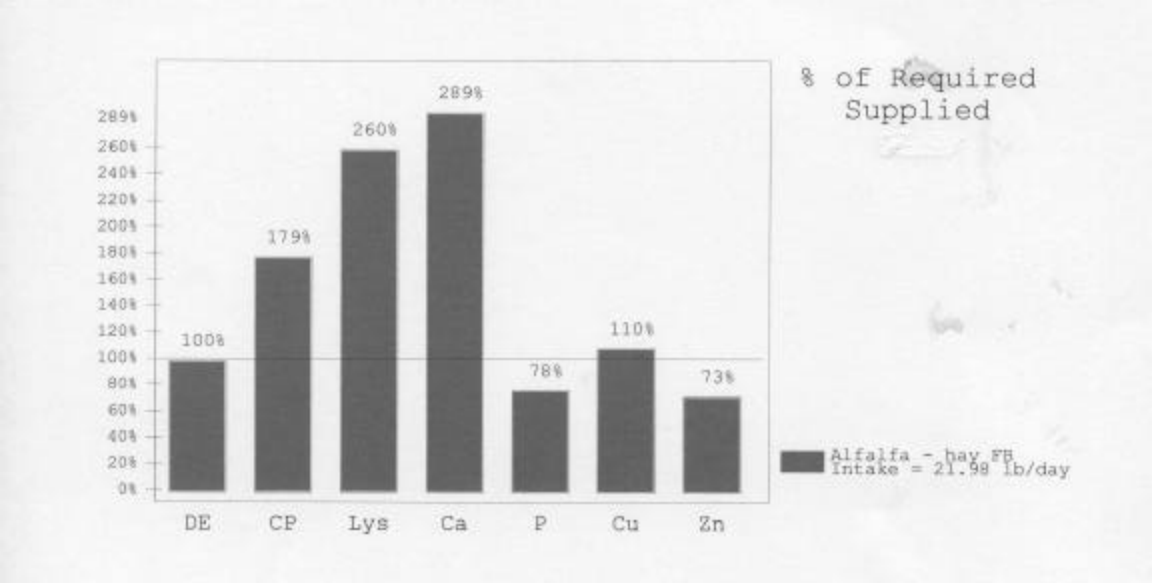

Figure 1. Percent of nutrient requirements met by a diet of full bloom alfalfa hay, fed to meet energy requirement, to an 1100 lb. mare in late gestation.

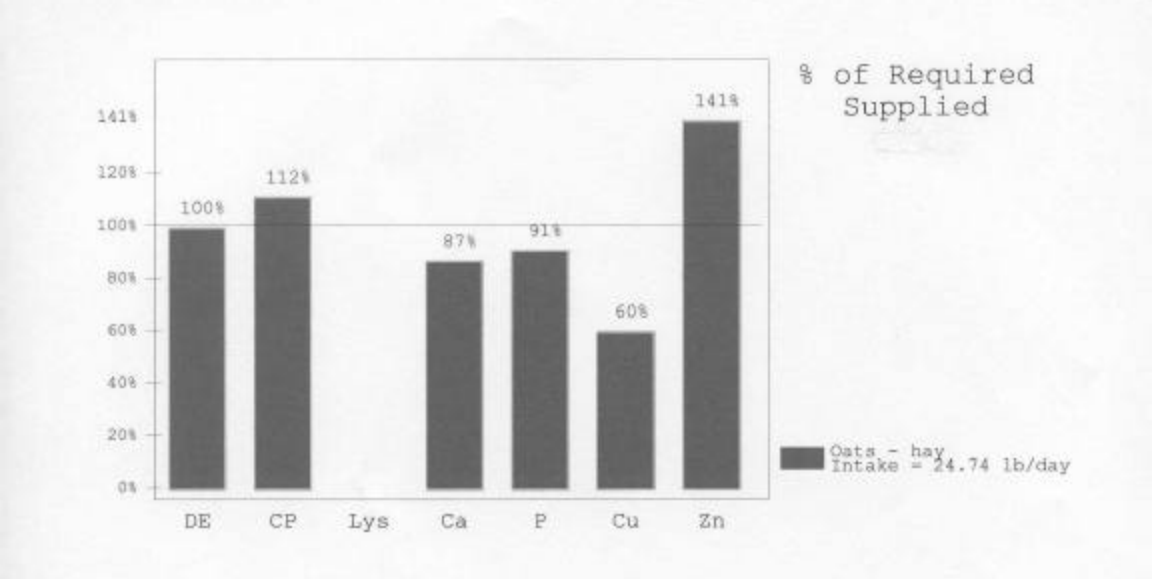

Figure 2. Percent of nutrient requirements met by a diet of oat hay, fed to meet energy requirement, to an 1100 lb. mare in late gestation.

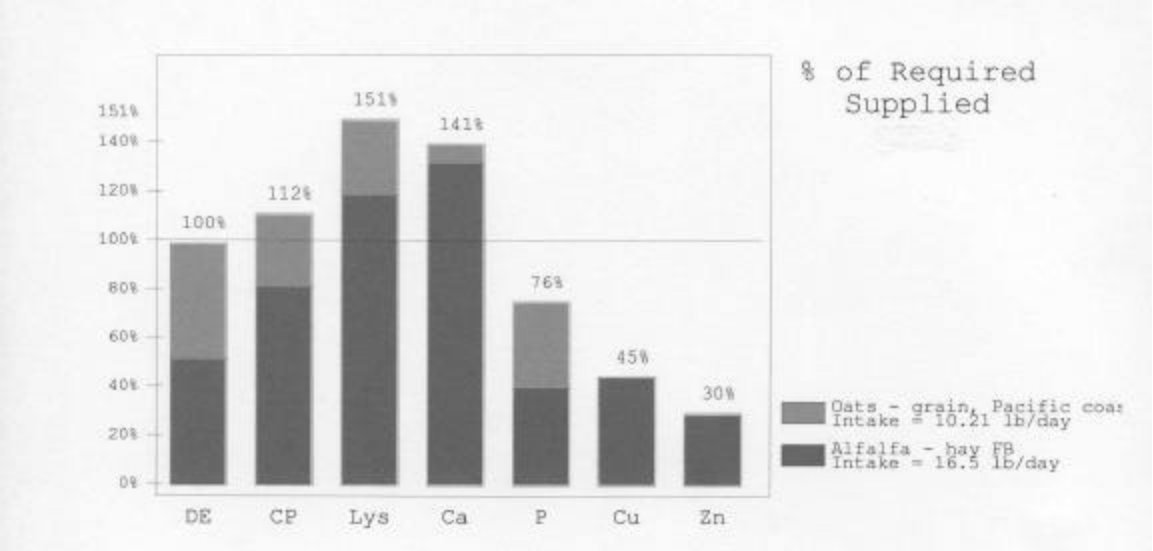

Figure 3. Percent of nutrient requirements met by a diet of 16.5 lbs. (1.5% of body weight) of full bloom alfalfa hay and oats (10.2 lbs.) fed to meet energy requirement, to an 1100 lb. mare in early lactation.

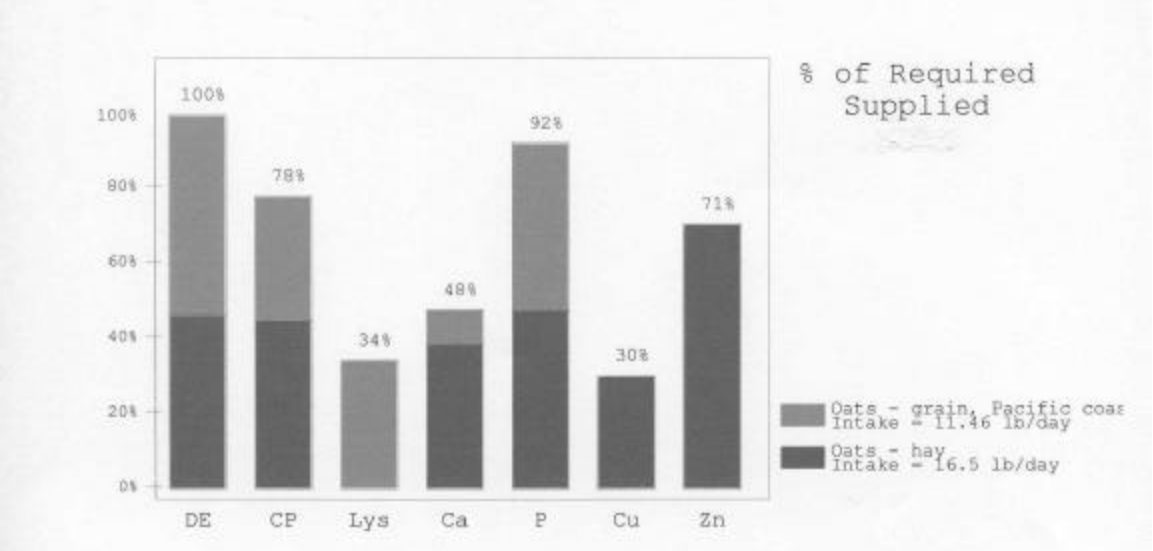

Figure 4. Percent of nutrient requirements met by a diet of 16.5 lbs. (1.5% of body weight) of oat hay and oats (11.5 lbs.) fed to meet energy requirement, to an 1100 lb. mare in early lactation.

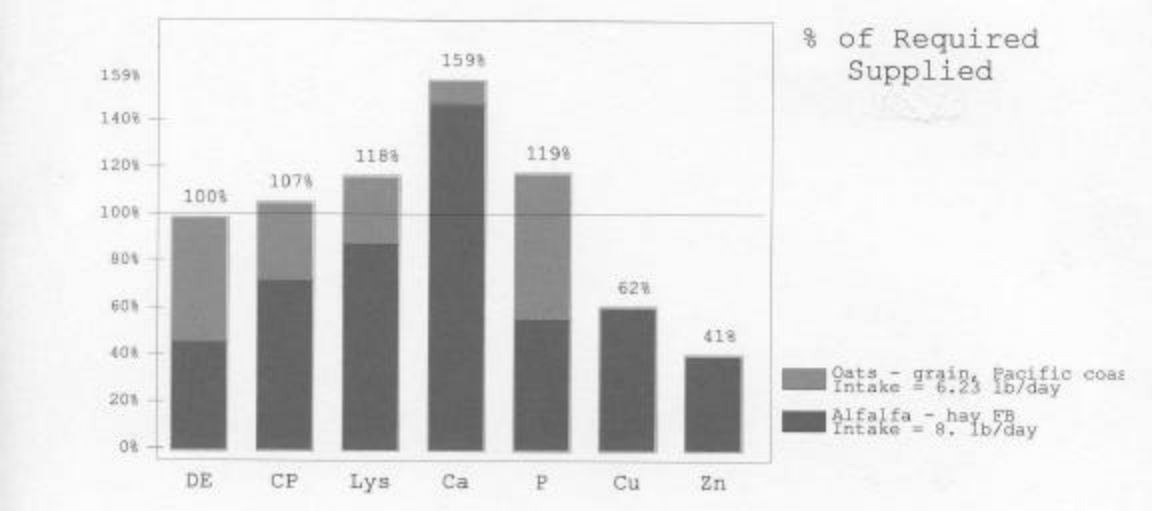

Figure 5. Percent of nutrient requirements met by 8 lbs. of full bloom alfalfa hay and oats (6.2 lbs.) fed to meet energy requirement, to a 6 month old weanling experiencing rapid growth (expected mature body weight of 1100 lbs.)

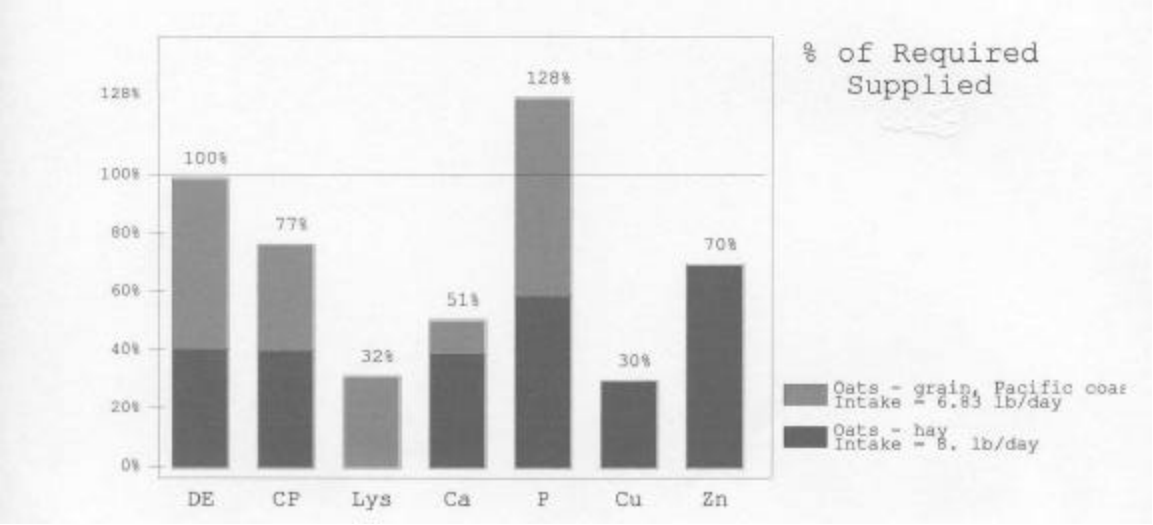

Figure 6. Percent of nutrient requirements met by 8 lbs. of oat hay and oats (6.8 lbs.) fed to meet energy requirement, to a 6 month old weanling experiencing rapid growth (expected mature body weight of 1100 lbs.)