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The Effects of Adding Grain and Supplements to Commercially Available Grain Mixes for Horses

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Horse farm feeding practices are as individual as the owners themselves. What works on one farm for feed selection and feeding practices doesn't produce the same results on a different farm. Much of the variation can be attributed to different genetic lines of horses, different types of pastures and hays, different exercise programs, horse housing differences, and differences between feeding routines. One commonly observed practice is on-farm addition of ingredients to commercially formulated grain mixes. The most commonly observed adjustment in Oklahoma is adding protein supplements, oats or corn. Adjustments in rations will affect the nutrient profile and cost of the ration. Analyzing these effects will enable you to make adjustments, which can increase the value of a ration rather than decrease it.

The first step in ration analysis is to estimate nutrient requirements. Nutrient requirements vary between horses in different states of production, growth and work. Adjustments in prepared rations will affect different classes of horses in a different way, so the value of altering prepared rations must be determined for each class of horses. Growing horses provide a good example because of their direct relationship with growth disorders and nutrient imbalances in rations. Yearlings are used in the following example.

Balancing to Meet Requirements

Requirements for growing horses are based on their body size and growth rate. Requirements for nutrients such as energy, protein, calcium and phosphorus must be balanced so nutrients promote healthy growth. The estimated nutrient requirement for a yearling is provided in Table 1. This yearling has an expected mature weight of about 1,200 pounds, is 12 months of age, and is gaining about 1.2 pounds per day.

Rations for growing horses are typically formulated for energy needs to be met when total intake of ration is between 2.25 percent and 2.75 percent of body weight each day. Digestible energy (DE) requirements are measured in Megacalories (Mcal). This yearling is estimated to need about 23 Mcal DE each day. The crude protein needs for the yearling is estimated to be at or slightly above 2.2 lbs each day. Calcium and phosphorus are two minerals of major importance for healthy growth. The minimum calcium need for this yearling is 45 grams per day. The yearling is estimated to need about 25 grams of phosphorus each day. Phosphorus needs are lower for all horses. Even if the needs for the absolute amounts of both minerals are being met, balance of calcium and phosphorus is important for efficient digestion and use of minerals. Horses such as this yearling should be fed total rations with about 1.8 times more calcium than phosphorus. Narrower ratios can be fed, but total rations with more phosphorus than calcium should be avoided absolutely, regardless of whether or not the needs are being met for the specific minerals.

As stated earlier, horses are fed diets ranging from all-forage to rations utilizing large amounts of grain. This example uses a base diet with a hay and a typically formulated grain mix at a 60 to 40 ratio. **Note:** This differs from previous publications which used a 60 percent grain/40 percent forage diet. The nutritional effect of altering this combination by adding a protein supplement, oats, and corn will be quantified through several examples.

Nutrient densities of commercially available mixes can be obtained from feed tags or the feed supplier. Estimates for energy content may also be obtained from suppliers or through feed testing. Assistance with testing forages and grains can be obtained through your local county Oklahoma

Table 1. Estimated Daily Nutrient Requirements for a Yearling[a].

Digestible Energy	*Crude Protein*	*Calcium*	*Phosphorus*	*Calcium:Phosphorus*
Mcal	lb	gm	gm	Ratio
23	2.2	45	25	1.8

[a] Calculated for an 850-pound, 12-month-old horse, gaining 1.2 pounds per day.

Cooperative Extension Service office. The nutrient densities of the feeds used in the following examples are provided in Table 2. The cost per pound of each was estimated from prices at the time of publication (December 2014). As with nutrient densities, costs will vary greatly between feedstuffs, locales and time of year, so information is intended to solely provide comparisons for the examples.

Meeting Requirements with a Commercially Available Grain Mix and Hay Ration

The yearling will need to consume about 21 pounds of total ration per day (about 2.5 percent of body weight) to meet its energy requirement (Table 3). The energy density of the grain mix and hay ration is approximately 1.1 Mcal/lb of total ration, which is typical of many grass hay/grain rations.

A comparison of the nutrient profile and requirements suggests this ration should meet the protein, calcium and phosphorus needs of this yearling. Calcium is supplied in slight excess of the estimated requirements, which is typical of many hay-prepared grain mix combinations, whereas phosphorus needs are easily met. Adequate minerals are provided in most commercially prepared grain mixes to safeguard against deficiencies caused by variation in hays. However, it is recommended to always examine the mineral content of the total diet, not just the grain mix. The mineral levels are not excessive and the ratio of calcium to phosphorus is about 1.2 to 1, which is on the lower end of the suggested acceptable ratio.

The cost of feeding this ration was calculated by determining the cost per pound of hay and grain and multiplying this cost by the amount fed. The cost of feeding one yearling per day (13 pounds of hay and 8 to 9 pounds of grain mix) was estimated at about $2.26 per day. Ten head of yearlings would consume $680 in hay and grain per month. Cost will vary depending on individual costs of hay and grain, and which associated costs such as labor are included in the amount. However, this amount can be used as a benchmark to observe cost differences when adding or mixing other feedstuffs.

Adding a Protein Supplement

It is common for horse owners to add a protein supplement to commercially prepared grain mixes. Supplements are added in hope of better meeting the protein, amino acid, mineral, or vitamin needs of horses. Depending on the nutrient profile in the hay-grain ration, it is common for 10 to 20 percent of yearlings to respond favorably to supplementation even when fed a mix calculated to meet minimal requirements. This is probably due to small differences in the protein and amino acid requirements between yearlings or differences in protein quality (amino acid balance) between the base ration and protein supplement. Amino acid profiles of commercially prepared grain mixes are variable. Protein supplements for horses usually have large concentrations of essential amino acids. Those horses consuming poor quality protein sources in grain mixes will respond more favorably to supplementation than those consuming high quality protein grain mixes. Replacing one pound of the grain mix with one pound of a commercially available 30 percent crude protein supplement provides the nutrient profile in Table 4.

Adding this supplement does not change the energy density as the supplement was estimated to be similar in energy content as the grain mix. Calcium and phosphorus are also contained in protein supplements, so concentrations of these nutrients would be expected to change. The content of calcium and phosphorus varies greatly between supplements, so careful monitoring is essential.

The cost of supplements varies greatly. The supplement used in this example was quoted to cost about $25.00 for 40 pounds ($1.60 per pound). Addition of the supplement increased the cost to $3.67 per day or $1100 for 10 head per month, an

Table 2. Nutrient Profiles of Example Feedstuffs Used in Comparisons.

Feedstuff	*Digestible Energy* *Mcal/lb*	*Crude Protein* *%*	*Calcium* *%*	*Phosphorus* *%*	*Cost* *per lb*
Grain mix	1.35	14	0.60	0.50	0.19
Hay	0.90	11	0.45	0.35	0.05
Protein supplement	1.35	30	0.80	0.60	1.60
Oats	1.35	12	0.14	0.40	0.20
Corn	1.60	8	0.04	0.30	0.13

Table 3. Nutrient Profile of a Ration Containing a 14% Grain Mix and Bermudagrass Hay[a].

Digestible Energy		*Crude Protein*		*Calcium*		*Phosphorus*		*Calcium:Phosphorus*
Mcal	*Mcal/lb*	*lb*	*%*	*gm*	*%*	*gm*	*%*	
23	1.1	2.6	12.2	49	0.51	40	0.41	1.2

[a]Densities are based on total ration intake of 21 pounds per day (2.5% of body weight).

Table 4. Nutrient Profile of the Supplemented Grain and Hay Ration[a].

Digestible Energy		Crude Protein		Calcium		Phosphorus		Calcium:Phosphorus
Mcal	Mcal/lb	lb	%	gm	%	gm	%	
23	1.1	2.8	13	50	0.52	40	.47%	1.3

[a]Densities are based on total ration intake of 21 pounds per day (2.5% of body weight).

increase of almost 60 percent above the base ration cost. Those farms feeding large numbers of horses that need supplementation may find that switching to a higher quality base mix is more economical to meet needs than relying completely on bagged protein supplements.

Replacing Part of the Grain Mix with Oats

On-farm addition of oats are added to grain mixes in order to reduce the energy concentration or increase the fiber concentration of rations (Table 5). Replacing half of the base grain mix with oats may reduce the digestible energy content of commercially formulated rations, so more total ration might have to be fed. In this example, the digestible energy density of oats and the grain mix were estimated to be similar, so total intake would be expected to be the same.

The crude protein intake would be expected to be slightly less as oats contain about 2 percent less crude protein than the grain mix. Protein quality would not be expected to be as high as many prepared mixes. Additionally, there is a concern in the amounts of calcium and phosphorus. Recommendations for minimal amounts of calcium are not met, and the calculated ratio of 1.0 is too narrow to recommend. Overall, this is a poor choice for a diet of a growing yearling.

Oat prices vary widely. At the time of this calculation, oat prices were quoted at $20 per hundred ($0.20 per pound). This cost is slightly more than the quote for the grain mix. Cost of this ration would be about $2.30 per head per day or $690 for 10 yearlings for one month, which is actually 2 percent higher than the original combination of grain mix and hay. Because of the lack of calcium, the potentially imbalanced calcium to phosphorus ratio, the probability that amino acid profile is not improved, and little economic incentive, combining prepared grain mixes with oats is not recommended. Adding a less expensive, high fiber feedstuff such as alfalfa pellets or soy hull pellets may be a better alternative to increase fiber intake in those instances that adequate long stem forage is not being supplied.

Nutrient Profile of Supplemented Grain Mix with Oats Added

It is a habit of some managers to make large changes in prepared feeds by mixing in oats and then adding supplements (Table 6). This is a combination of the two examples provided above, with one pound of protein supplement replacing the half and half mixture of grain and oats. This mixture is intermediate between the original hay and grain mix, and the supplemented grain mix. There probably is an increase in some of the essential amino acids, but responses may not be noticed because of such small differences. As with the oat added, non-supplemented ration, the big concern is with minerals and the potential for calcium deficiencies and imbalanced ratios that is possible with some supplementations. Estimates in this example suggest per head cost of $2.80 per day or $840 for 10 head per month, which is a 24 percent increase above the base ration. If employing such a strategy, it is vital that the complete nutritional profile of the data be examined. In this example, adequate calcium is not supplied, which is again not recommended for a growing horse.

Table 5. Nutrient Profile of the Grain and Hay Ration with Added Oats[a].

Digestible Energy		Crude Protein		Calcium		Phosphorus		Calcium:Phosphorus
Mcal	Mcal/lb	lb	%	gm	%	gm	%	
23	1.1	2.5	12	38	0.39	38	0.39	1.0

[a]Densities are based on total ration intake of 21 pounds per day (2.5% of body weight).

Table 6. Nutrient Profile of the Supplemented Grain and Hay Ration with Added Oats[a].

Digestible Energy		Crude Protein		Calcium		Phosphorus		Calcium:Phosphorus
Mcal	Mcal/lb	lb	%	gm	%	gm	%	
23	1.1	2.7	13	42	0.43	38	0.40	1.1

[a]Densities are based on total ration intake of 21 pounds per day (2.5% of body weight).

Table 7. Nutrient Profile of the Grain and Hay Ration with Added Corn[a].

Digestible Energy		*Crude Protein*		*Calcium*		*Phosphorus*		*Calcium:Phosphorus*
Mcal	*Mcal/lb*	*lb*	*%*	*gm*	*%*	*gm*	*%*	
23.6	1.11	2.4	11.5	46	0.47	37	0.39	1.2

[a]Densities are based on total ration intake of 21 pounds per day (2.5% of body weight).

Table 8. Nutrient Profile of the Supplemented Grain and Hay Ration with Added Corn[a].

Digestible Energy		*Crude Protein*		*Calcium*		*Phosphorus*		*Calcium:Phosphorus*
Mcal	*Mcal/lb*	*lb*	*%*	*gm*	*%*	*gm*	*%*	
23.6	1.11	2.6	12.3	47	0.49	38	0.39	1.2

[a]Densities are based on total ration intake of 21 pounds per day (2.5% of body weight).

Adding Corn to a Grain Mix

Some managers will add corn to grain mixes to increase the energy concentration of the ration. Corn is a relatively dense source of energy; however, the ration may become imbalanced. Replacing 30 percent of the grain mix with corn provides the nutrient profile in Table 7. The energy content of the total ration is slightly greater with the addition of the corn, but there is a corresponding decrease in protein relative to the initial hay and grain ration. This is the least amount of protein of any of the rations calculated as of yet, and just meets our yearling's calcium requirement. The projected cost of this ration, based on available quotes for corn is about $2.10 per head per day, or $630 for 10 head per month. Even though less expensive than the other examples, the potential for lowering optimal growth outweighs the economic characteristics of this ration for use with growing horses.

Nutrient Profile of Supplemented Grain Mix with Added Corn

Although not as often as with oats, some managers will add corn to grain mixes and then supplement with a protein supplement. The nutrient profile of this combination is provided in Table 8. Energy density is similar to the previous example; however, crude protein intake is similar to levels in the original ration and desired amino acid profiles would be expected to be better because of the addition of the protein supplement. Cost calculations are $3.53 per head per day or $1,060 for 10 head per month. Increased costs are the biggest concerns with this ration.

Summary and General Recommendations

Both nutritional profiles and cost factors should be considered when grains and hays are being selected to meet horses' nutrient requirements. This article provides comparisons for altering commercially available grain mixes with protein supplements and grains on farm. The cheapest, but the most variable source of nutrients, will always be forage, and should be considered first when formulating a diet.

The only recommended practice of these examples is adding a protein supplement when the hay-grain mix combination is marginally supplying protein and essential amino acids. Protein supplements are most commonly fed when nutritional programs are being accelerated, for example during preparation for sale or show. The expected results will depend on the nutrient profile of the grain mix and forage being consumed, as well as individual horse response.

Addition of oats to increase the fiber content of the grain mix is not recommended because of changes in cost and mineral profiles. Other high fiber feedstuffs, such as alfalfa meal or soy hulls, may be a better alternative to increase the fiber content in rations of horses that are on restricted forage diets. Replacing a portion of the grain mix with corn is not recommended in rations for growing horses because of a potential for imbalances of protein and minerals.

The most common recommendation is to select a prepared grain mix based on the nutrient content of the hay and adjust the ration intake level to meet the desired growth rate. Unknowledgeable mixing of whole grains to prepared rations may not only be expensive, it may also cause unfavorable production, growth, or work performance.

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