

Nutrition for Maximum Performance

By Eleanor Blazer

LESSON SIX

* If you have questions while studying this lesson please send me an e-mail.
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KNOW THE NUMBERS

Balancing feed rations for horses requires some basic math skills. Knowing how to apply the knowledge gained from the information on forage samples and feed tags is important.

The easiest way to learn the math is to do a feed evaluation.

Here are the steps:

1. Examine the horse:
 - a. Determine his age
 - b. Activity level
 - c. Body condition score
 - d. Approximate current weight
 - e. Desired weight
 - f. Height
 - f. List his health problems
2. Use this information to research his daily nutritional requirements.

The book from the National Research Council - [NUTRIENT REQUIREMENTS OF HORSES](#), 6th Revised Edition, contains charts which give averages for nutrient requirements based on the above information.

If you are going to try to balance feed rations it is highly recommended you acquire a copy of this book.

3. Try to find out what nutrients the forage is providing. A hay test is the best way. If you cannot take a hay test you can use the charts in the NRC book **Nutrient Requirements of Horses**, or do research online. There is a test for mature coastal Bermuda grass hay in this lesson.

4. Locate the nutrient information for the type of commercial mix, grain or supplements you are feeding. This information will be on the feed tag, product label or you may have to do research online. The NRC book gives averages for most popular grains and other feeds fed to horses.
5. Find a calculator, a pencil and a lot of paper.

Our feed evaluation of "Red":

Red is a 900-pound Quarter Horse gelding. He is 8 years old and has no health problems. He stands about 15.2 hands. (62 inches at the withers.)

His activity level would be light. He gets ridden and competes occasionally. His body condition score is a 4.

BODY CONDITION SCORE

The body condition score chart is used to evaluate body condition of the horse by rating the amount of fat covering certain parts of the body.

The parts of the horse examined are the (1.) crest of the neck, (2.) either side of the withers, (3.) behind the elbow – girth area, (4.) ribs, (5.) loins and (6.) tailhead. The areas should be inspected visually and felt with the hand. [Click here to see picture.](#)

The scoring system is:

1. Poor

A walking skeleton. The horse is emaciated with no sign of body fat. The tops of the vertebrae (spinous processes), ribs, tailhead, point of hip (tuber coxae), and the point of the buttocks (ischii) project prominently. The bone structure of the withers, shoulders, and neck is easily seen. [Click here to see picture.](#)

2. Very Thin

Emaciated. There is a slight covering of fat over the base of the vertebrae. The broad flat lateral bones projecting from the lumbar vertebrae (transverse processes) feel rounded. Vertebrae, ribs, tailhead, points of hips, and buttocks are prominent. The structure of the withers, shoulders, and neck structure is faintly discernible. [Click here to see picture.](#)

3. Thin

There is fat buildup about halfway on the vertebrae, but they can still be seen. The lumbar vertebrae cannot be felt. There is some fat over the ribs, but they are still easily visible. The tailhead is prominent, but the individual vertebrae cannot be seen. The points of the buttocks are not distinguishable. Withers, shoulders, and neck are accentuated. [Click here to see picture.](#)

4. Moderately Thin

There is a slight ridge along the back. A faint outline of ribs can still be seen. Depending upon conformation the tailhead may be prominent, but some fat can be felt around it. The points of hips and buttocks are not discernible. The withers, shoulders, and neck are not thin in appearance. [Click here to see picture.](#)

5. Moderate

The back is flat with no crease or ridge. Ribs are not visible, but can be felt with very slight pressure. Fat around the tailhead feels somewhat spongy. Fat along the withers and over the top of the back vertebrae make them somewhat rounded. The shoulders and neck blend smoothly into the body. [Click here to see picture.](#)

6. Moderately Fleshy

There may be a slight crease beginning to form down the back. The fat over the ribs will feel spongy and the fat around the tailhead will be soft. Fat will be starting to form along the sides of the withers, behind the shoulders, and along the sides of the neck. [Click here to see picture.](#)

7. Fleshy

There may be a slight crease down the back. Individual ribs can be felt, but there is a noticeable filling of fat between them. The fat around the tailhead is soft. There are deposits of fat along the withers, behind the shoulders, and along the neck. [Click here to see picture.](#)

8. Fat

There is a crease down the back. It is difficult to feel ribs. The fat around the tailhead is very soft. The withers and area behind the shoulders are filled in with fat. The neck is thick with fat and fat deposits are along the inner thighs. [Click here to see picture.](#)

9. Extremely Fat

There is an obvious crease down the back. Patches of fat cover the ribs. There is bulging fat around the tailhead, along the withers, behind the

shoulders, and along the neck. The inner thighs may rub together and the flank will be filled with fat. [Click here to see picture.](#)

(Body Condition Score pictures courtesy of Buckeye Nutrition.)

DETERMINING BODY WEIGHT

The formula for determining a horse's body weight is:

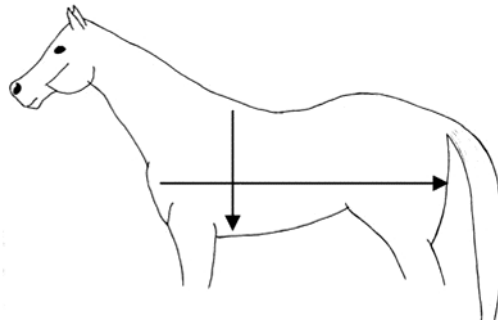
Adult horses:

Heart girth measurement in inches, squared (the number multiplied by itself) times his length divided by 330.

(The heart girth measurement is taken just behind the elbow, around the barrel, and up over the withers. Keep the tape snug, but not tight. The length measurement is taken from the point of the shoulder blade to the point of the buttocks.)

Foals one to 6 weeks of age:

Heart girth measurement in inches subtract 25.1 divide by .07



Locations for using the formula

Weight tapes are not accurate and can be off by as much as 100 pounds. A scale designed for weighing horses is the most accurate method used to weigh a horse, but availability is limited.

THE FORAGE

Red is receiving 12 pounds of hay each day. [Click here to see a copy of the hay test.](#)

He is being given the standard two flakes in the morning and two flakes at night. The flakes weigh about three pounds each.

This hay test is for coastal Bermuda grass cut late in the season. It is mature and coarse. The relative feed value is 79, which makes it poor as far as digestibility. Unfortunately it is pretty close to the type of hay many horses are receiving.

If you do not want to test your hay or you get hay in small amounts from different suppliers this hay test will work for most mature coarse grass hays.

The book from the National Research Council - NUTRIENT REQUIREMENTS OF HORSES, 6th Revised Edition, contains charts which give averages for nutrient composition of different feeds used for horses. These charts list types of forages at different maturity levels and their average nutrient values. It can work as a guideline if the hay cannot be tested.

If you are going to try to balance feed rations it is highly recommended you acquire a copy of this book. It can be ordered from the [National Academies Press](#).

THE GRAIN

Our horse is receiving four pounds of a commercial mix (Buckeye Supreme Horse Pellets) each day.

Buckeye Supreme Horse Pellets (33450)

TYPE OF FEED: Fortified Grain Mix
FORM OF FEED: Pellets
PACKAGING: 50 lb Paper Bags
SPECIES: Horses
AGES: Long Yearlings and Mature

FEATURES:

- Added vegetable oil for an efficient energy source
- Balanced amino acids for muscle development
- Added yeast culture for improved digestion
- Chelated minerals for increased absorption
- Added vitamin E to maintain muscle integrity
- 4 pounds equal 1 "Balanced Nutritional Unit" (4:1)

GUARANTEED ANALYSIS:

Crude Protein, Minimum			14.00%
Lysine, Minimum			0.80%
Crude Fat, Minimum			6.00%
Crude Fiber, Maximum			8.00%
Starch, Actual			31.00%
NFC, Actual			38.00%
Calcium, Minimum	0.60%	Maximum	1.10%
Phosphorus, Minimum			0.60%
Potassium, Minimum			0.80%
Copper, Minimum			45 ppm
Zinc, Minimum			130 ppm
Selenium, Minimum			0.6 ppm
Vitamin A, Minimum			5000 IU/lb
Vitamin D, Minimum			500 IU/lb
Vitamin E, Minimum			90 IU/lb

INGREDIENTS: Wheat Middlings, Ground Corn, Heat Processed Soybeans, Dehydrated Alfalfa Meal, Soybean Hulls, Yeast Culture, L-Lysine, DL Methionine, Cane Molasses, Vegetable Oil, Calcium Carbonate, Calcium Phosphate, Salt, Potassium Chloride, Potassium Sulfate, Magnesium Sulfate, Magnesium Oxide, Manganese Sulfate, Manganous Oxide, Ferrous Sulfate, Copper Sulfate, Zinc Sulfate, Polysaccharide Complex of Manganese, Polysaccharide Complex of Iron, Polysaccharide Complex of Copper, Polysaccharide Complex of Zinc, Cobalt Sulfate, Ethylenediamine Dihydrochloride, Calcium Iodate, Sodium Selenite, Vitamin A Supplement, Vitamin D3 Supplement, Vitamin E Supplement, Thiamine Mononitrate, Riboflavin, Niacin, Pyridoxine Hydrochloride, Folic Acid, Biotin, d-Calcium Pantothenate, Choline Chloride, Vitamin B12, Ascorbic Acid, Anise Flavor.

Red is being given the standard one scoop in the morning and one scoop at night. The scoop holds two pounds of this feed.

(If you cannot get the links to load please e-mail me at elblazer@horsecoursesonline.com)

Our goal for Red is to make sure he is getting the nutrients he requires each day. He is slightly thin for a horse that stands 15.2 hands and has a body condition score of 4. **We would like him to weigh 1,100 pounds.**

The approximate daily nutritional requirements for a mature 1,100-pound horse with a light work load are:

Digestible Energy/Mcal: 20
Crude Protein: 699 grams (10%)
Calcium: 35 grams (.30% of the diet)
Phosphorus: 18 grams (.25% of the diet)
Sodium (Na): 13.9 grams
Copper: 100.0 mg (milligrams)
Zinc: 400.0 mg
Selenium: 1.00 mg
Vitamin A: 22,000 I.U.
Vitamin D: 3,300 I.U.
Vitamin E: 800 I.U.

These daily nutrient requirements are taken from the National Research Council's book – NUTRIENT REQUIREMENTS OF HORSES, 6th Revised Edition, 2007.

There are other minerals and vitamins horses require. I only listed these because they are the easiest on which to find information. The following formulas will help you calculate the other vitamins and minerals should you decide to delve deeper into the balancing feed rations. If you decide to do that – you will need the NRC book "Nutrient Requirements of Horses".

So let's see what the current feed is providing. We are going to base our calculations on what we would like Red to weigh – 1,100 pounds. You want to feed a horse according to what he should weigh – not what he currently weighs.

We will use the dry matter nutrient levels on the hay test.

CALCULATING DIGESTIBLE ENERGY

The 1,100 pound adult horse at a light work activity level requires about 20 DE/Mcal per day.

The forage is providing .86 DE/Mcal per pound.

The grain is providing 1.50 DE/Mcal per pound.

12 pounds of forage times .86 DE/Mcal = 10.32 DE/Mcal
4 pounds of grain times 1.50 DE/Mcal = 6.00 DE/Mcal
Total DE/Mcal per day = 16.32

Red is getting 16.32 DE/Mcal per day. He is short by 3.68 mega calories each day. By increasing the calories he would increase weight. (I would do this by increasing the amount of hay he is eating.)

It is not required to have calories stated on feed tags, so the manufacturer will have to be contacted for that information. (I had to call Buckeye Nutrition to get the mega calories for our example.)

CALORIES:

When measuring energy in food or feed we measure the calories.

A calorie (spelled with a small "c") represents the amount of energy it takes to raise one gram of water one degree Celsius (1.8 degrees Fahrenheit).

A Calorie (spelled with a capital 'C') represents the amount of energy it takes to raise one kilogram (1,000 grams) of water one degree Celsius. The Calorie is also called a kilocalorie. This is the rate of measurement used in human nutrition. Many times it is not spelled correctly. The correct spelling for human nutrition is a capital 'C'.

A mega calorie (Mcal) is 1,000 kilocalories. Mega calorie is the rate of measurement used to measure energy in a large animal's diet, such as the horse. I will use mega calorie in the course...the correct method for large animals.

CALCULATING CRUDE PROTEIN

According to the NRC Red requires 699 grams of protein each day.

The forage is providing 47 grams per pound adjusted crude protein. (See the hay test.)

Red is eating 12 pounds of hay, so 12 times 47 equals 564. The hay is providing 564 grams of protein to Red a day.

Determining the amount of protein the mix is providing takes some calculating.
Here's the math:

Step 1: We need to convert the percent of protein in the mix to a decimal value. In order to do this we must move the decimal point over two places. Buckeye Supreme Horse Pellets contain a crude protein of 14.0%. The number we will be working with in our calculations is **0.14**.

Step 2: We need to convert the pounds of mix to grams. There are 453.6 grams in a pound. Red is getting four pounds of mix a day...or 1,814 grams. (453.6 times 4 equals **1,814**.)

Step 3: Now we can determine how many grams of protein the mix is providing. 14 percent of the mix is protein. **1814** times **0.14** equals 253.96. So 253.96 grams of protein a day being provided by the mix (we'll round it off to 254).

Step 4: For the total amount of protein being provided by the feed add the totals for the hay and grain. 564 (hay) plus 254 (mix) for a total of 818 grams of protein.

Red is getting 818 grams of protein a day.

Excess protein is expelled from the body through the urine. It does not build up and create problems. If a horse already has a renal problem (kidney damage) excessive protein is not desirable, but excessive protein will not cause renal failure.

Another method of determining protein amounts for a horse uses the percentage numbers.

A horse of Red's type (mature and not worked hard) requires 10.0% protein a day.

The forage is providing 10.4% crude protein (dry matter basis). Buckeye Supreme provides 14.0% crude protein.

$$\begin{array}{r} 12 \text{ pounds of forage times } 10.4 \text{ crude protein} = 124.80 \text{ units} \\ \underline{4 \text{ pounds of mix times } 14.0 \text{ crude protein} = 56.00 \text{ units}} \\ 16 \text{ total pounds} \qquad \qquad \qquad 180.80 \text{ units} \end{array}$$

180.80 divided by 16 pounds = 11.3 % crude protein per day.

These calculations also show Red is getting enough protein each day.

CALCULATING CALCIUM LEVEL

Red requires 35 grams of calcium per day.

The forage is providing 1.75 grams per pound (see hay test). Red is eating 12 pounds of hay. 12 times 1.75 equals 21. 21 grams of calcium per day being provided by the hay.

Determining the calcium being provided by the grain requires more calculations.

Step 1: Buckeye Supreme provides a minimum of 0.60 and a maximum of 1.10 percent. We'll take an average and use 0.90 percent.

We need to convert the percent of calcium in the mix to a decimal value. Move the decimal point over two places. 0.90 percent now becomes **0.0090**.

Step 2: We need to convert the pounds of mix to grams. There are 453.6 grams in a pound. Red is getting four pounds of Supreme a day...or **1,814** grams.

Step 3: Now we can determine how many grams of calcium the mix is providing. 0.90 percent of the mix is calcium. **1814** times **0.0090** equals **16.33** grams of calcium a day being provided by the mix.

Step 4: For the total amount of calcium being provided by the feed add the totals for the hay and grain. 21 (hay) plus 16.33 (Supreme) for a total of 37.33 grams of calcium a day.

Red is receiving 37.33 grams of calcium a day.

Red is getting enough calcium in his diet. Adult horses can tolerate as much as six times the recommended amount of calcium as long as enough phosphorus is being provided to maintain the correct calcium to phosphorus ratio. One point one to two (1.1 to 2) parts calcium to one (1) part phosphorus.

Another method of determining calcium levels is by using the percentage numbers.

Red's calcium requirements are 0.30% per day.

The forage is providing 0.39%.

The calcium in the mix averages about 0.90%. (Not less than 0.60% and not more than 1.10%)

$$\begin{array}{r} 12 \text{ pounds of forage times } 0.39\% = 4.68 \\ \underline{4 \text{ pounds of grain times } 0.90\% = 3.60} \\ 16 \text{ pounds} \qquad \qquad \qquad 8.28 \end{array}$$

8.28 divided by 16 pounds = 0.52% calcium per day

CALCULATING PHOSPHORUS LEVEL

We do the same steps to calculate phosphorus level.

Red's phosphorus requirements are 18 grams per day.

The hay is providing 1.02 grams per pound. 12 pounds of hay times 1.02 equals 12.24 grams of phosphorus being provided by the forage.

Buckeye Supreme contains 0.60% phosphorus, so move the decimal over two places and multiply by the amount of mix (in grams). 1814 grams times 0.0060 equals 10.88 grams of phosphorus being provided by the Buckeye Supreme.

Red is getting **23 grams of phosphorus a day**. (12.24 plus 10.88 equals 23.12)

The percentage method:

Red needs 0.25% in phosphorus per day.

The hay is providing 0.22 percent.

The Supreme is providing 0.60 percent.

$$\begin{array}{r} 12 \text{ pounds of forage times } .22\% = 2.64 \\ \underline{4 \text{ pounds of mix times } .60\% = 2.40} \\ 16 \text{ pounds} \qquad \qquad \qquad 5.04 \end{array}$$

5.04 divided by 16 pounds = 0.315%
(Phosphorus requirements are being met.)

Horses can tolerate as much as 30 grams of phosphorus per day. The ratio of calcium to phosphorus is the critical part.

- You use the above formulas for calculating any nutrient level based on percentage.

CALCULATING CALCIUM AND PHOSPHORUS RATIO

The diet is providing Red with 37.33 grams of calcium and 23 grams of phosphorus. To figure the ratio - divide the calcium level by the phosphorus level: 37.3 divided by 23 equals 1.62.

The ratio is 1.62 parts calcium to 1 part phosphorus.

The percentage method:

The calcium level is 0.52%. The phosphorus level is 0.315%

Divide the calcium number by the phosphorus number:

0.52% divided by 0.315% = 1.65

The ratio is within the desired limits: 1.65 parts calcium to 1.00 part phosphorus.

SODIUM

According to the NRC Red's sodium requirements are 13.9 grams each day.

The hay is providing 0.015 percent sodium. Change it to a decimal value: 0.00015.

Now convert the 12 pounds of hay to grams: 453.6 times 12 equals 5443.20 grams of hay.

Multiply the 5443.20 grams of hay times the 0.00015 sodium =
0.816

Our feed tag does not give the sodium level. It is not required to list sodium content on the feed tag. We can pretty much assume there is not much in the product.

Red is receiving 0.816 grams of sodium a day. This is why free choice loose salt must be offered.

CALCULATING PPM

You will notice on the feed tag and hay test copper, zinc and selenium values are stated as "ppm". "PPM" means "parts per million". (The hay test does have it stated as milligrams per pound, also.)

Let's check the copper to see what Red is getting in his diet.

Red requires 100 milligrams (mg) of copper per day. – based on the 2007 Nutrient Requirements of Horses. The hay is providing 10 ppm (see hay test – dry matter basis). The commercial mix we are using (Buckeye Supreme) contains 45 ppm (see feed tag).

The first step is to convert ppm (parts per million) to milligrams.

PPM = milligrams per kilogram

Red is eating 12 pounds or 5,443 grams of hay. He is also eating four (4) pounds or 1,814 grams of the commercial feed mix.

To make things easy use this converter:

http://www.onlineconversion.com/weight_common.htm

Convert the 5,443 grams of hay to kilograms. 5 443 gram = 5.443 kilogram

Multiply the 10 ppm (from the hay test) times 5.443 =

The hay is providing **54.43** milligrams of copper. (10 times 5.443)

(You can use the calculations for milligrams of copper per pound provided by the hay test – 5.0 mg/lb. 12 pounds of hay times 5.0 equals 60 milligrams. You will find nothing is ever precise when calculating feed rations.)

Convert the 1,814 grams of Supreme Pellets to kilograms. 1 814 gram = 1.814 kilogram

Multiply the 45 ppm (from the feed tag) times 1.814 =

The mix is providing **81.63** milligrams of copper. (45 times 1.814)

Add the milligrams of copper from the hay (54.43) to the milligrams of copper from the Buckeye Supreme (81.63) and **Red is getting 136.06 milligrams of copper every day.**

According to the NRC Nutrient Requirements of Horses the upper safe limit of copper for an adult horse at maintenance activity level is 4,000 milligrams. There are no benefits to feeding more copper than is required for the age and activity level of any horse. Excessive copper can

interfere with the absorption of zinc. Zinc to copper ratio must be about 4:1 (four to one).

Copper is needed for the development, repair, and maintenance of tendons, ligaments, joints, and other connective tissues. It is also important to brain function, the manufacturing of red blood cells, reproduction, pigmentation of the hair coat, and supporting antioxidant activity. Sufficient copper levels are required for broodmares and performance horses. Recent research has proven copper is very important to bone development in young growing horses.

It is also thought only about 20-40 percent of the copper provided by the diet is absorbed in the digestive system. Research regarding absorption rates vary and are not consistent.

Red's copper requirements are being met and are not close to the upper safe limit, so he is fine.

Now let's check the zinc:

Zinc level in the hay – 5.443 kilograms of hay times 39 (see hay test – 39 ppm) equals 212.28

Zinc level in the feed mix – 1.814 kilograms of mix times 130 (see feed tag – 130 ppm) equals 235.82.

Add the two together: 212.28 plus 235.82 equals 448.10.

Red is getting 448 milligrams of zinc per day. His requirement according to the NRC is 400 milligrams.

Zinc has a very low risk of toxicity. The upper safe limit for a 1,100 pound adult horse at maintenance level is around 5,000 milligrams. But there is no reason to over supplement zinc. The zinc to copper ratio should be 4:1.

- Use the above formula for calculating any nutrient level that uses parts per million.

Don't forget to check your zinc to copper ratio. (4 :1)

448 milligrams of zinc divided by 136 milligrams of copper equals 3.3. So the ratio of zinc to copper is 3.3 to 1. The ratio is pretty close. Remember these are estimates and nothing is ever perfect – we just want to get as close to perfect as we can.

Now let's check the selenium Red is receiving.

You will notice there is no selenium level stated on the hay test. Most of the United States is deficient in selenium, so laboratories do not test for it unless requested.

The selenium level in Buckeye Supreme Horse Pellets is 0.6ppm (see feed tag). We need to turn that into milligrams available.

Remember – One ppm equals milligram per kilogram

Red is eating 1.814 kilograms of the Buckeye Supreme. So 0.6 (amount of selenium in the mix) times 1.814 equals 1.0884.

Red is getting 1.08 milligrams of selenium. His requirement according to the NRC is 1.0 mg. Red's getting what he needs.

Feed manufacturers in the United States and other parts of the world that are deficient in selenium add it to their mixes. As long as you feed according to the feeding directions you should meet selenium requirements.

CALCULATING VITAMIN LEVELS

Feed manufacturers in the United States are only required to list vitamin A on the feed tag. (Refer to lesson two.)

VITAMIN A

The 1,100 pound adult horse at a light work load has a requirement of about 22,000 International Units of Vitamin A per day. The grain is providing 5,000 I.U. per pound.

Red is eating four pounds of the mix. 4 pounds of mix times 5,000 I.U. = 20,000 I.U. of Vitamin A per day.

Red is getting about 20,000 I.U.'s of vitamin A each day. He is a little short on vitamin A.

Hay is not tested for vitamin levels. The longer hay is stored, the lower the vitamin levels become. There may be some vitamins in the hay, but there may not.

The upper safe limit of vitamin A is thought to be approximately 80,000 I.U. per day for an adult 1,100 pound horse.

VITAMIN D

Red's requirement according to the NRC: 3,300 I.U.

Feed mix is providing: 2,000 I.U. (4 pounds times the 500 units the Supreme is providing.)

Red is getting 2,000 I.U.'s of vitamin D per day.

Vitamin D is provided by the sun. As long as Red gets one hour of sunlight a day he would be meeting his requirements.

The upper safe limit of vitamin D is thought to be around 11,000 I.U. per day for an adult horse at a maintenance work load. It is very easy to reach vitamin D toxicities with over supplementation.

VITAMIN E

Red's requirement according to the NRC: 800 I.U.

Feed mix is providing: 360 I.U. (4 pounds times the 90 units the Supreme is providing.)

Red is getting about 360 I.U.'s of vitamin E each day.

There is no known toxic level for vitamin E. But because excessive amounts of any fat soluble vitamin could interfere with other fat soluble vitamins, the NRC has suggested an upper safe limit of 10,000 I.U.'s per day.

Vitamin E is needed for the absorption of selenium. Red needs some type of vitamin E supplementation.

RED'S NUTRITIONAL PROFILE:

Red's requirements according to the NRC's Nutrients Requirements for Horses (2007):

Digestible Energy/Mcals: 20
Crude Protein: 699 grams (10%)
Calcium: 35 grams (.30% of the diet)
Phosphorus: 18 grams (.25% of the diet)
Sodium: 13.9 grams
Copper: 100.0 mg (milligrams)
Zinc: 400.0 mg
Selenium: 1.00 mg

Vitamin A: 22,000 I.U.
Vitamin D: 3,300 I.U.
Vitamin E: 800 I.U.

The approximate nutrients Red is receiving with 12 pounds of our hay and four pounds of Buckeye Supreme Horse Pellets for one day:

Digestible Energy/Mcals: 16.32
Crude Protein: 818 grams (11.3%)
Calcium: 37.33 grams (0.52% of the diet)
Phosphorus: 23 grams (0.33% of the diet)
Sodium: 0.816 grams
Copper: 136.0 mg (milligrams)
Zinc: 448.0 mg
Selenium: 1.00 mg
Vitamin A: 20,000 I.U.
Vitamin D: 2,000 I.U.
Vitamin E: 360 I.U.

Calcium to phosphorus ratio: 1.65 : 1
Zinc to copper ratio: 3.3 : 1

IMPORTANT NOTE:

All these calculations do not take the place of common sense. Feeding horses is also an art. Observation is the key to everything dealing with horses.

Will Red die because of nutrient deficiencies or excesses on his current diet? The answer is "No". He could use some slight adjustments, but nothing is life threatening.

Be careful when adding supplements to a diet. For example we learned in lesson five (SUPPLEMENTS & NUTRACEUTICALS) it is very easy to over supplement vitamin A. Without knowing what the diet is lacking it will be hard to decide on a supplement. It may be one is not needed if the forage quality is good and the correct commercial mix is being offered (in the correct amount).

It was my opinion Red could use some more weight. The first thing I would do is increase his hay, this would also increase the other nutrients. I would allow him to eat all he could hold. Horses are designed to consume forage continually. Also the nutrients in this hay will be difficult to utilize (RFV of 79) so it will take more to help reach his requirements.

Red should weigh 1,100 pounds. Based on nutritional research, horses should eat 1.5 to 2.0 percent of their weight in forage a day; Red needs 16.5 to 22 pounds of hay each day. I would rather increase the hay than increase the grain....it is safer.

It is possible Red is not going to be able to eat enough of this hard-to-digest hay. The coarse material may fill his cecum and create a "hay belly".

If after several months he does not gain weight I would consider changing the commercial mix. Another option would be to add a fat supplement and a vitamin/mineral supplement that compliments the forage. Free choice white granulated salt must be provided, regardless of the feed changes.

The best thing, for Red, would be to find better quality hay.

HELPFUL CONVERSIONS

1 ounce = 28.3 grams

1 kilogram (kg) = 2.205 (2.2) pounds

1 pound = .4536 kilograms (453.6 grams)

1 gram is about the weight of a paper clip.

ECONOMICS

When purchasing grain, "cheap" usually turns out to be expensive. With cheap grains, amount fed per head per day, poor performance, poor growth, cost of supplements, and possible veterinarian bills can add to the debit side of the ledger sheet.

Let's look at three examples of horse concentrates.

“Economy Horse Feed” Retail Price: \$ 10.00 per 50 pounds

Feeding directions: Feed horses in light training 1.5 – 2% of their body weight per day, along with adequate forage, free choice salt, and water.

“High Quality Horse Feed” Retail Price: \$15.00 per 50 pounds

Feeding directions: Feed horses in light training .5 – 1% of their body weight per day, along with adequate forage, free choice salt, and water.

“Ration Balancer” Retail Price: \$22.00 per 50 pounds

Feeding directions: Feed horses weighing 1,100 pounds in light training 1.5 pounds with 5 pounds of oats per day, adequate forage, free choice salt, and water.

Now let's do the math. We are feeding an adult performance horse weighing 1,100 pounds.

“Economy Horse Feed” price per pound: 0.20 (\$10.00 divided by 50). Feed 1.5% of the horses body weight (1,100 multiplied by .015) = 16.5 pounds per day. 16.5 pounds times 20 cents per pound = \$3.30
Cost of grain: \$3.30 per day

“High Quality Horse Feed” price per pound: 0.30 (15.00 divided by 50).
Feed .5% of the body weight (1,100 multiplied by 0.005) = 5.5 pounds per day.
5.5 pounds times 30 cents per pound = \$1.65
Cost of grain: \$1.65 per day

“Ration Balancer” price per pound: .44 per pound (\$22.00 divided by 50). Feed horses weighing 1,100 pounds in light training 1.5 pounds each day. (1.5 pounds times 44 cents) Cost of Ration Balancer: \$0.66 per day.

The ration balancer provides the protein, vitamins and minerals needed by a 1,100-pound adult horse at maintenance for one day.

To add mega calories oats can be added to the ration balancer:

Oats price per pound: \$0.24 (\$12.00 divided by 50). Cost of Oats: \$1.20 per day (5 pounds times 24 cents)

Cost of ration balancer and oats: \$1.86 per day (total of balancer, \$0.66 and oats, \$1.20)

The **“Economy Horse Feed”** is the most expensive to feed. Also, notice the amount needed to be fed per day: 16.5 pounds. An 1100-pound horse should never be fed more than 5 pounds at one feeding, so this means the amount needs to be divided into 3 feedings.

I can almost guarantee if a person fed the economy horse feed to a performance horse the feed room will be stacked with various types of expensive supplements.

When feeding horses cheap is not cheap...cheap can be very expensive.

* You may never have to use the calculations provided in this lesson. Most of the time if you chose a commercial mix designed for the age, activity level, health of the horse, forage type and feed according to the feeding directions the ration will be close to what is needed.

If you do want to get involved in balancing feed rations you will need the NRC book [Nutrient Requirements of Horses](#).

Research may have to be done to find nutrient levels of some feeds or supplements given to horses that are not common...such as whole sunflower seeds.

There are also software programs available so you do not have to do the calculations by hand.

[**Click Here To Take Quiz**](#)

ASSIGNMENT:

Please send assignment to elblazer@horsecoursesonline.com You can also send it via FAX 1-830-438-6192. Please send me an e-mail if you are sending it by FAX. Make sure you include your calculations. Also put your full name and e-mail address on the document...not just in your e-mail or FAX cover sheet.

1. Using the sample hay test what are Red's approximate nutrient levels (based on dry matter), if we increased his hay to 20 pounds a day? (Do not add grain or supplements.) Include the steps you did to reach your answers.

Digestible Energy/Mcals:

Crude Protein:

Calcium:

Phosphorus:

Copper:

Sodium:

Zinc:

Calcium to phosphorus ratio:

Zinc to copper ratio:

2. How do these numbers compare to his requirements according to the NRC? (What are your findings?)

3. What would you add to Red's diet to balance his ration? You can adjust the amount of hay he is now receiving, from the 20 pounds, to what you think he needs.

You'll have to do research to find feeds or supplements. Please send me the product/supplement name, the feeding directions (if it is a commercial product) and the nutrient level of the items you choose or include a link to the product if it is on line.

Remember to tell me how much (in grams, milligrams or other measurements – not in scoops) you would give him.

Show all calculations to support your findings. Include his final nutrient levels with the hay and products you choose. You may have to adjust the amount of hay he is receiving.

You will not be able to reach a perfect level...there is no such thing as perfect. Our goal is to provide some of the nutrients he is lacking without going too high.

Red currently weighs 900 pounds and we would like him to weigh 1,100 pounds.