

# Basic Ration Balancing

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## Introduction

An animal's ration is the diet that you draw up for them on paper. Basic ration balancing involves the selection of feedstuffs that will mix together to meet requirements for a specific animal or group of animals. Ration balancing is a complex topic that can be intimidating but the best designed feed mix (or ration) is the simplest one. Some diets are intended to be a standalone "complete mixed feed" (Figure 1), whereas, others are designed as supplements to boost energy or protein for animals consuming forages or grains. At its core, ration balancing requires a foundational knowledge of feedstuffs and what nutrient classes they primarily provide. Those feedstuffs are then mixed in ratios that meet the requirements of the specific type of animal you are feeding.

The objective here is to describe the process by which to identify feedstuffs for inclusion in a basic ration but not an all-inclusive guide to building your own feed mix. It would be impossible to teach ration balancing in only a few pages; this process takes practice and years of experience to build comfort with the skillset. If you would like to learn more about building your own feed ration, please reach out to your local feed mill and ask to meet with their nutritionist for help.



Figure 1. An example of a complete mixed sheep feed.

## Nutrient Requirements

Decades of research with animal feeding across species, physiological stages (e.g., lactation, pregnancy, growth, etc.), and at different ages have led to data tables which outline animal nutrient requirements in each specific case. Animal species have, on average, 40 essential nutrients generally classified into six nutrient classes: water, protein, carbohydrates, fats, vitamins, and minerals. However, each species is slightly different in nutritional requirements. For example, pigs require considerably less fiber (a carbohydrate) in their diet compared to a horse or ruminant, such as a cow or goat. In contrast, chickens have similar requirements for calcium as other species, but when they are egg layers, their calcium requirement can increase by more than 5-fold.

It is important to set a goal first for what animal you want to feed and what your objectives are before you begin to balance a ration. Once you have identified your animal species, physiological state, and goal (e.g., average daily gain), then you can proceed to search the requirements for that particular type and group of animals.

## Growing Animals

Most commonly, youth exhibitors are working to balance rations for growing animals. Growing animal requirements will be scaled to current body weight and target average daily gain. Animal growth requirements hinge on the animal's current body weight and your next projected goal weight. To set a goal weight, you must know the animal's current weight. Therefore, it is critical to estimate animal body weight accurately. While a well-maintained scale is the best tool to measure animal body weight, a tape measure or seamstress tape can help estimate body weight within 2 to 3 lbs on most species. A simple web search for "livestock body tape weight estimates" will return instructions on how to estimate animal body weight with a measuring tape. Typically, this involves measuring from the point of the shoulder

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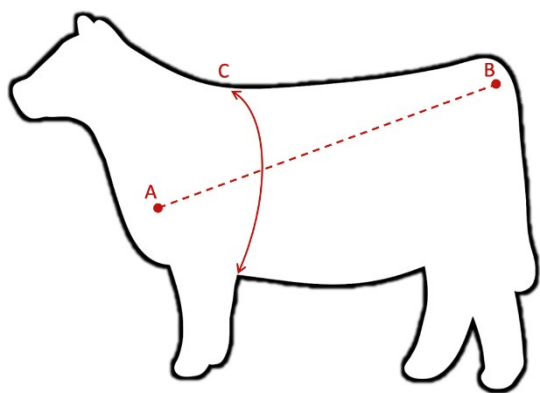


Figure 2. Livestock body tape weight estimate example. In this beef example, the tape stretches from the point of the shoulder (A) to the tailhead (B) to measure length.

to the dock or tailhead (length), then measuring girth behind the shoulder (Figure 2). These measurements can be combined into an estimated body weight using species-specific equations which are available online. Once you know the current weight, set a goal weight and the number of days you will take to achieve it. The weight to gain divided by the number of days is the target average daily gain.

As a general rule, the faster the animal is expected to grow, the more it will require dietary energy (from starch carbohydrates or fats) and protein. Younger animals are assumed to be smaller and consume less feed each day; therefore, younger animals usually require a greater percentage of key nutrients such as proteins in their diet. It may seem confusing because a smaller animal does not require more protein by weight or mass consumed – they only require a greater **concentration** of protein because they consume less total feed. As animals mature and consume more feed, the percentage of protein in the diet commonly decreases and it is replaced by more energy in the form of non-structural carbohydrates or fats.

## Foundational Feedstuffs

Once you know the general requirements for your animal, it is time to select feedstuffs that are highly correlated to the nutrient classes needed to meet your animal's requirements. There are two foundational feedstuffs in animal nutrition that should be a common entry in most rations: corn and soybean meal. Corn provides significant quantities of starch (a non-structural carbohydrate) that is high in energy and very cost-effective. However, corn is low in protein and the protein it contains is particularly poor nutritional quality. Soybean meal (Figure 3) is a co-product from the soy oil industry and the remaining part of the soybean is high in quality crude protein, up to 50% crude protein in many samples with a balance of essential amino acids.



Figure 3. Soybean meal is identified by the small chunks, sweet smell, and light color.

Using your target crude protein percentage in the diet, combining corn and soybean meal in a Pearson square (Figure 4) should give a rough estimate for a base grain mix. You could substitute some corn out for other cereal grains rich in energy such as barley, oats, or wheat. You can also substitute out soybean meal for other high protein feedstuffs but beware of cost. Soybean meal is typically

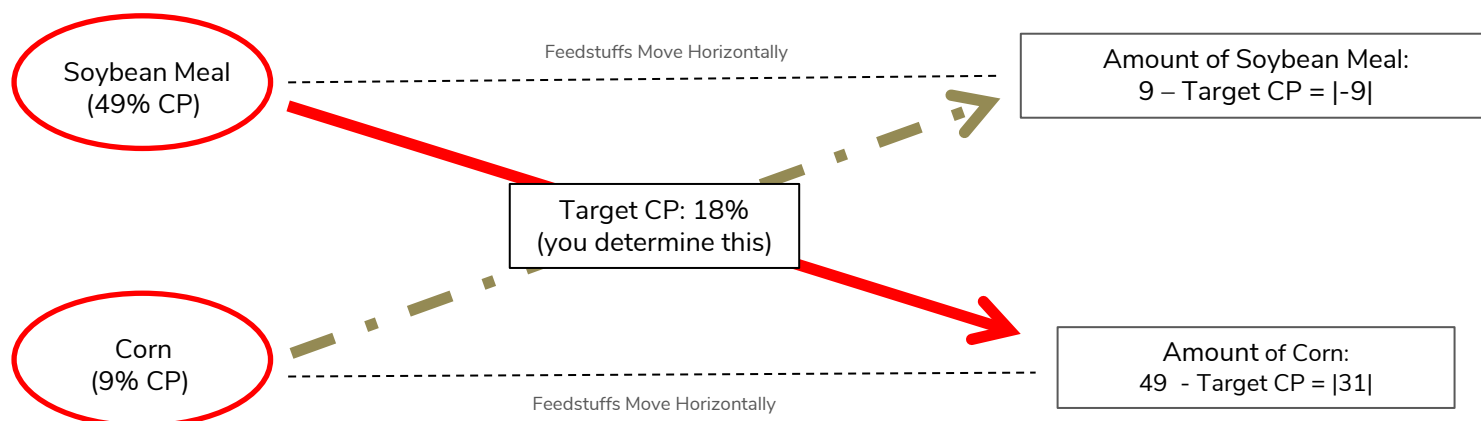


Figure 4. Pearson Square ration calculation example. See "Steps to Complete a Pearson Square" at the bottom of the next page.



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Figure 5. Wheat middlings are a common fiber ingredient in diets for animals like pigs or chickens. They also can constitute bulk in pellets.

the most cost-effective protein feedstuff available.

### Importance of Fiber

Depending on the species of choice, there is a good chance that the animal will require some fiber to maintain gut function. This is especially true in our hindgut fermenters (horses, rabbits), ruminant species (cattle, sheep, goats), and pseudo-ruminants (llamas and alpacas). Fiber can come into the diet through traditional feedstuffs such as pasture, hay, or silages. Or, non-traditional byproduct fibrous feedstuffs can also meet this fiber requirement. It is increasingly common to include some byproduct fiber in the diet of many animals, especially show animals, with common choices being beet pulp, soy hulls, wheat middlings (Figure 5), and cottonseed hulls. If you are showing your ruminants, plan to include, **at a minimum**, 10% fiber (15 to 20% of your feed mix should be a fiber source) to help maintain rumen health. More fiber is good for gut health and function, but very high fiber diets can lead to poor animal growth if the animal is not getting enough energy from high energy feedstuffs like grain carbohydrate sources or fat supplements.

### Premixes

Once the mix contains carbohydrate and protein sources, and the fiber inclusion has been considered, the next step is to cover the mineral and vitamin requirements of the animal. Each individual mineral and vitamin can be included and met but many companies offer a premix that can address all needs at the same time. Premixes are a ready-made combination of all the minerals and/or vitamins that your animal requires. Typically, the pre-mix label lists the species and intended physiological stage or body weight

appropriate for the mix. The premix will list how many ounces an animal will require each day or the appropriate percentage to mix into your feed per ton of feed produced. Consult with your local mill for guidance on what premixes might be important for your animals.

### Price

After gaining experience in drafting animal rations, you may become more comfortable mixing your feed and try to reduce the feed cost. Feed mixes through your local mill are an opportunity to add unique feedstuffs into your ration or to reduce your ration cost compared to traditional bagged feeds. It is likely that you can reduce your feed cost by up to 50% when mixing your own feed compared to a bagged mix. However, it is important to keep in mind what you gain when purchasing a bagged feed. Bagged feeds are professionally made and account for the nutrient requirements of your specific type of animals. Consumers of bagged feeds rely on the producer to guarantee the feed is appropriate for their animals and most companies have experts available to contact with questions.

### Summary

Mixing your own feed can be a rewarding experience and offer a unique challenge in raising livestock animals. With it comes the risk and responsibility of making sure that you have met the unique requirements of your animals. Accuracy of rations begins with understanding the nutrients provided by your feedstuffs so that you can calculate how much of a nutrient is provided by each feedstuff. It is probably best to utilize an online office tool like a spreadsheet to calculate the nutrients provided by each feedstuff in your designed mix.

### STEPS TO COMPLETE A PEARSON SQUARE:

- 1) Subtract feed CP from target for each feedstuff
  - 1) Amount of Soybean Meal:  $9 - 18 = |-9| = 9$
  - 2) Amount of Corn:  $49 - 18 = |31| = 31$
- 2) The difference is the units needed for each feedstuff
  - 1)  $31 + 9 = 40$  total units
- 3) Divide feedstuff units by summed total units, and multiply  $\times 100$  to get percent inclusion of each feed
  - 1)  $(9/40) \times 100 = 22.5\%$  Soybean Meal
  - 2)  $(31/40) \times 100 = 77.5\%$  Corn

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