<h1 style="text-align:center">Methods of Diet Balancing</h1>

Balancing on the Basis of Percentage

When all ingredients in a diet are mixed together, such as swine diets or high concentrate diets for finishing cattle, the diet is balanced so that the mixture will meet the animal's requirements when fed basically ad libitum. These diets are balanced on a percentage basis (or concentration such as amount per kg) and several tons of the diet may be mixed at the same time. In this case, the animal's **ration** consists of a given amount of the **diet** fed per day.

Balancing on the Basis of Amount per Day

When feeds are not usually fed as a mixture, or when animals are not being fed ad libitum, as when feeding a cow a given amount of hay and grain per day, the usual practice is to balance on the basis of amount fed per day. The required nutrients must be supplied within the limits of the daily dry matter intake of the animal, or within the limited amount of feed fed per day.

Steps in Diet Balancing

1. Determine nutrient requirements of animals involved.
   Consider age, sex, species, production level and environmental conditions.
2. Choose the basal feed(s).
   Basal feed(s) - form the largest portion of the diet, usually the most economical source of energy available.
   Consider cost, availability and appropriateness for the animal species.
3. Compare composition with requirements.
4. Choose major supplement that will best correct deficiencies in basal feed(s).
5. Balance first for protein and/or energy.
6. Calculate content of other nutrients and compare with requirements.
7. By substitution, add the necessary ingredients to correct any deficiencies.
8. Compare final result to requirements.

Remember, nutrient requirements and the feedstuff composition must be on the same basis! (Both in the same units, and both DM basis or both as-fed basis)

What Nutrients Should Be Considered?

Ruminants
1. Energy - can be expressed as TDN, DE, ME or NE_l, NE_m, NE_g
2. Protein
3. Macro minerals - Ca, P, NaCl, K, Mg
4. Trace minerals - Se, Cu, Co
5. Fat-soluble vitamins - vitamin A, vitamin E, vitamin D

Non-ruminants
1. Protein (or amino acids when the requirements are known)
2. Energy - can be expressed as DE or ME
3. Macro minerals - Ca, P, NaCl
4. Trace minerals - Fe, Zn, I
5. Fat-soluble vitamins - vitamin A, vitamin E, vitamin D
6. Water-soluble vitamins - thiamine, riboflavin, pantothenic acid, pyridoxine, choline, vitamin B_{12}, niacin

Pearson Square Method - Balancing for 1 Nutrient Using Simple Mixtures

1. Draw a square, and in the middle write the concentration of the nutrient desired.
2. At the left corners of the square write the concentrations of that nutrient in the ingredients being used.
3. Subtract diagonally, and disregard the sign of the answers.
4. At top right is the number of parts of ingredient #1, and at bottom right is the number of parts of ingredient #2. (Don't be confused by the fact that the parts of #1 came from ingredient #2 and vice versa, have faith and it will work out!)
5. Add the parts of ingredient #1 and the parts of ingredient #2.
6. Obtain the percentage of each ingredient by dividing its parts by the total parts.
7. Check to see that the % of the ingredient in the diet x its nutrient composition for both ingredients adds to the requirement.

% CP (ingredient #1)   Parts of ingredient #1

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┌─────────────────────────┐
│                         │
│    % CP requirement     │
│                         │
└─────────────────────────┘
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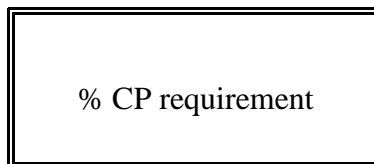
% CP (ingredient #2)   Parts of ingredient #2
                                                                                      Total parts

% of ingredient #1 in diet = (Parts of ingredient #1/Total parts) x 100
% of ingredient #2 in diet = (Parts of ingredient #2/Total parts) x 100

Guidelines for Pearson Square:
1. can only be used to balance for 1 nutrient, but any nutrient can be used.
2. can only be used to balance with 2 ingredients, but both can be mixtures of feeds.
3. the number in the center must be between the compositions for that nutrient in the two ingredients used, for example any combination of a 10% CP grain and a 45% CP supplement will be somewhere between 10% CP and 45% CP.
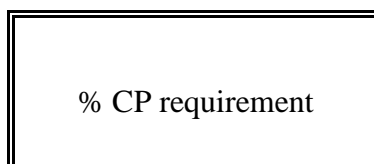
Using Pearson Square with an Ingredient that is a Mixture
Suppose we wanted to use more than just 2 feedstuffs to balance a diet for 1 nutrient. We need to combine the additional feeds into a mixture so that we still have 2 ingredients in the Pearson Square.

Nutrient content of mixture = (nutrient content feed #1   X   % feed #1 in mix) +
                                        (nutrient content feed #2   X   % feed #2 in mix) etc.

Then use Pearson Square as before.

% CP (ingredient #1)   Parts of ingredient #1

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┌─────────────────────────┐
│                         │
│    % CP requirement     │
│                         │
└─────────────────────────┘
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% CP (ingredient #2)   Parts of ingredient #2
                                                                                      Total parts