FEED FORMULATION

The hidden maths behind every bag of animal feed

Every bag of feed is the answer to a maths problem. We open the bag: nutrient targets, ingredient values, a worked Pearson square, least-cost formulation and why feed cost per kg of gain beats price per bag.

By FeedSport Nutrition Team · Published 23 October 2026 · Updated 29 October 2026 · 5 min read

KEY POINTS

- Every feed is built to a specification of energy, protein, amino acids, minerals and fibre for one species and stage.
- A maize and soybean meal mix at 18% crude protein works out to about 74% maize and 26% soya meal with the Pearson square.
- Real feeds balance a dozen or more nutrients at once, so mills use least-cost formulation (linear programming) to find the cheapest recipe that meets every target.
- Judge a feed on feed cost per kg of gain (FCR × price per kg), not on the price of the bag.

Every bag of feed on a farm shelf is the answer to a maths problem. Someone had to decide how much maize, soya, minerals and vitamins to mix so that a chicken, pig or cow gets exactly what it needs, at the lowest possible cost.

You never see that working on the label. But it decides how fast your animals grow, how healthy they stay, and how much money is left over when you sell. In this article we open the bag and look at the numbers inside.

Step one: know the target

The maths starts with the animal, not the ingredients. Nutritionists set a target for each species and each stage of life, and those targets change fast as animals grow.

A typical specification sets minimums and maximums for:

- **Energy** (megajoules or kilocalories per kg) to fuel growth and activity
- **Crude protein**, and more importantly the **amino acids** inside it, especially lysine and methionine

- **Calcium and phosphorus**, in the right ratio for bones and eggshells
- **Fibre**, kept within limits so the gut works properly
- **Salt, vitamins and trace minerals**, usually supplied through a premix

A broiler chick in its first weeks needs a starter diet with roughly 22% crude protein. A grower pig needs closer to 16%, and a dry cow far less. One feed cannot do every job well, which is why starter, grower and finisher bags exist.

Step two: see every ingredient as a column of numbers

To a formulator, maize is not just yellow grain. It is a list of nutrient values per kilogram, and so is every other ingredient. Here are approximate typical values for the two workhorses of Zimbabwean feed:

Ingredient	Crude protein (%)	Lysine (%)	Role in the diet
Maize	about 8–9	about 0.25	Cheap energy, low protein
Soybean meal	about 44–46	about 2.8	Concentrated protein and lysine

Maize brings energy but too little protein. Soya brings protein but costs far more per kg. Neither works alone. The question every feed bag answers is: in what proportions should they meet?

Real values vary between batches, seasons and suppliers. Good mills test their raw materials rather than trusting textbook figures, because a few percentage points of protein shift the whole formula. If you buy ingredients, ask for the batch specification and learn how to read it.

Step three: a worked example with the Pearson square

Say you want a simple mix of maize and soya meal at **18% crude protein**. Using maize at 9% and soya meal at 44%, the Pearson square gives the answer in three subtractions.

1. Soya side: 44 − 18 = **26 parts maize**
2. Maize side: 18 − 9 = **9 parts soya meal**
3. Total: 26 + 9 = 35 parts

So the mix is 26 ÷ 35 = **74.3% maize** and 9 ÷ 35 = **25.7% soya meal**. Check it:

$$(0.743 \times 9) + (0.257 \times 44) = 6.69 + 11.31 = 18.0\%$$

Now add cost. With illustrative prices of US$0.30/kg for maize and US$0.65/kg for soya meal, the blend costs about **US$0.39 per kg** before minerals, premix and milling. Change either price and the cost moves with it, but the protein stays locked at 18%.

For a broiler example that adds minerals, amino acids, premix and the hidden costs of mixing, see how to mix your own broiler feed.

Step four: when one target becomes twenty

The Pearson square handles one nutrient and two ingredients. A real feed has to hit energy, protein, lysine, methionine, calcium, phosphorus and fibre all at once, from ten or more ingredients. Fix one and you often break another.

This is where **least-cost formulation** comes in. It uses a branch of maths called **linear programming**, the same tool airlines use to schedule flights. You give the software three things:

- **Ingredients** with their nutrient values and today's prices
- **Constraints**: the minimums and maximums for every nutrient, plus limits on ingredients such as "no more than 5% sunflower meal"
- **One goal**: make the mix as cheap as possible

The software tests the combinations and returns the cheapest recipe that meets every constraint. When soya prices jump, it may swap in cotton cake or synthetic lysine. When maize is cheap after harvest, it leans on maize. The animal sees the same nutrition; the recipe quietly changes underneath.

Let the software do the sums

FeedSport Studio runs least-cost formulation for pigs and poultry. Choose the animal and stage, enter the ingredients you have and what you pay, and get the cheapest recipe that meets every requirement.

Take the Studio tour | Try the free feed calculator

Why this maths matters on your farm

The cheapest bag is not always the cheapest feed. What counts is the **feed conversion ratio (FCR)**: how many kg of feed it takes to put on 1 kg of live weight. Multiply FCR by the price per kg and you get your real number, the feed cost per kg of gain.

Feed	Price per kg	FCR	Feed cost per kg of gain
Feed A (well balanced)	US$0.50	1.7	**US$0.85**
Feed B (cheaper, poorly balanced)	US$0.45	2.0	**US$0.90**

Illustrative figures. Feed B looks 10% cheaper on the shelf, yet every kilo of meat costs more to produce. Across a batch of 1,000 broilers, that gap adds up quickly.

In Zimbabwe, where maize and soya prices swing with the season, the rains and the exchange rate, this matters even more. A feed built on sound formulation keeps nutrition steady while costs move, so your animals grow on schedule and your margins hold.

Which bag is really cheaper for you?

Send us the feeds you are choosing between, what you pay and the FCR you get. We will work out your feed cost per kg of gain and show you where the money goes.

Compare my feeds

The takeaway

Behind every bag of feed is a careful balance of targets, ingredient values and prices, worked out so your animals get what they need at a cost that makes sense. You don't have to do the maths yourself, but knowing it is there helps you ask the right questions.

Next time you compare feeds, look past the price tag. Ask what stage the feed is built for, check the protein and energy on the label, and track your FCR. The numbers will tell you which bag is really the better buy.

Prices in this article are illustrative. Run the sums again with the prices you pay today.

Want a feed built on the right numbers?

Whether you buy complete feed or mix your own, our nutrition team will help you choose the right feed for each stage and source the ingredients, premixes and concentrates at today's prices.

WhatsApp the team | Other ways to contact us

Need a diet checked? Send your ingredients and targets to the FeedSport nutrition team on WhatsApp +263 77 468 4534 or sales@feedsport.co.zw.

Figures in this guide are typical values and general ranges. Confirm targets for your animals, genetics and ingredients, and check batch specifications before formulating.