

 **FARMINGUK**

KNOWLEDGE CENTRE



SPY IN THE BAG - LAYING HEN NUTRITION

Ever wondered what's in your hens feed but were too afraid to ask? In this article Zoe Kay helps producers understand what their birds are eating and why.

A variety of ingredients, or raw materials, are included in laying hen rations to provide the nutrition they need. Some of those selected will change over time depending on price and availability. Listed below are raw materials that regularly feature in UK diets for free-range hens, with an explanation of the nutrients they provide.

Nutrient requirements change as the bird grows and at different stages of the production cycle. Nutritionists from the genetics companies and the feed manufacturers put together specifications; based on extensive research and feeding trials. Then the feed formulator's job is to meet the hen's requirements in the most efficient and effective manner.

Major Nutrients

Protein is required for muscle development, hence growth, and egg production. Accordingly a level of crude protein will be recommended for different ages of bird. Feathers are 80 percent protein and supplying sufficient to ensure a good covering is important for feed conversion ratio (FCR).

Amino-acids are the building blocks of protein and hens have specific requirements for them, over and above the level of protein. Different physiological processes, including growth and egg production will be limited by the availability of certain amino acids. A less than adequate supply will also have a negative effect on FCR. Diets will normally

be formulated to the first three to five, of the seven essential amino-acids: Methionine, Cystine, Lysine, Threonine, Tryptophan, Isoleucine and Valine.

Fats supply energy, which is required for all physiological processes. Supplying the right amount of energy for birds, to put on lean mass, is key to efficient egg production. Balancing energy density of the diet with consumption is a major factor in controlling egg size.

Fatty acids as well as supplying energy can influence aspects of egg production. High levels of linoleic acid increase egg size and this effect is used in early lay to achieve saleable eggs. Levels can then be reduced to control egg size following peak production.

Carbohydrates come in a variety of forms from simple sugars to starch. They all supply energy but will need to be broken down to a greater or lesser extent for it to be released.

Fibre affects the physical structure of the feed and maybe soluble or in-soluble. The ration should supply a mixture of dietary fibre to optimise digestive transit and maintain a beneficial gut microbiota – both important for FCR. Providing adequate fibre increases gizzard size and can reduce feather pecking.

The importance of **vitamins and minerals** to bird health and performance is enough for an article in itself. So only those

added outside of the pre-mix are discussed. **Calcium** makes up, in the form of carbonate, most of egg shell as well as being essential for skeletal development. Shell weight increases throughout lay so higher calcium levels are needed at the end of lay. **Phosphorus** is also involved in skeletal development and energy metabolism, making adequate provision essential for growth and efficiency.

Raw Materials Macro ingredients

Wheat is the most common cereal grown in the UK and provides birds most importantly with energy, in the form of carbohydrates. Functionally wheat works well in a layers mash, providing a coarse substrate. **Maize** is imported and rarely competitive for use in conventional diets. It may be used in organic diets as it contains carotenoids, which help to improve yolk colour. **Barley & Oats** may be used seasonally when available at a good price but fibre levels impose limits. **Cereals** provide around two thirds of the energy content of a layer diets, primarily from starch. And although cereals are relatively low in protein, because they make up around half of the diet, they in fact provide 40% of the protein.

Soya bean meal provides about a quarter of the protein in diets, as well as supplying energy from fats and carbohydrates.

Sunflower meal also provides around 25 percent of dietary protein, along with energy and is

a very useful source of fibre. **Oil seed rape meal** is a useful product that is not included as often as it could be. It is a sustainable source of protein, as well as supplying energy. These three are co-products from oil extraction; soya and sunflower are imported, whilst oil seed rape is home-grown.

Wheat feed contains less starch than wheat but is a useful source of minerals, fibre and some protein. **Maize by-products** are available from factories producing sweeteners and can be a useful source of pigments as well as protein. **Bakery meal** will include a selection of baked goods, crisps and confectionary; which mainly supply energy. These by-products from the human food industry are cost-effective nutrient sources. Using them improves sustainability, as long as they properly defined and from a known source.

Dried distillers grain with solubles (DDGS) is a by-product of the bio-ethanol industry, supplying energy, protein and fibre. Its use is limited to feed manufacturing near the plants but as experience grows will feature more often. The challenge is sourcing enough of a consistent product.

Peas will be used seasonally when the price is favourable. They will feature as a protein source, more often in organic diets. **Grass meal** is also used more regularly in organic diets, as a natural source of methionine and yellow pigments.

Oils add fat, hence energy to the diet but also play a role in binding the diet. **Soya oil** is high in linoleic acid, whilst Palm oil has lower levels. **Sunflower oil** and **rape seed oil** may also be included in fat blends.

Micro ingredients

Limestone supplies calcium in the diet and may be included in graded particles or granules. Large particles offer a slow-release source, whilst finer ones are readily available. **Marine shells** can also be used to supply slow-release calcium and can be added to the diet or provided separately. **Mineral phosphates (mono- or di-calcium)** supply some of the bird's phosphorus requirements. However, raw materials, in particular cereals contain calcium and phosphorus; and enzymes are used to help release it from the diet.

The **premix** contains the all the micro-minerals and vitamins a hen needs, as well as enzymes (if not liquid), pigments and any optional extras. Yolk colour is important measure of egg quality and consumer acceptance and whilst some pigments are naturally present in the diet, more needs to be added. To get an orange yolk, you need to add a yellow (generally **Marigold**) and red (either **Paprika** or a **nature-identical pigment**). Protein in the diet should supply much of the hen's **amino acid** requirements but some will be topped up with synthetic versions.

Most laying hen diets will include **Enzymes**, which help to release

more nutrients from the raw materials in the diet. Phytases break down in-digestible phytate in cereals, making the phosphorus available to hens. It also acts to reduce the addition of mineral phosphates, improving sustainability. Xylanase and Beta-gluconases are also added to break down non-starch polysaccharides (NSPs) found in cereals, releasing more energy. Optional extras may be added to the hens diets at different times, with the aim of helping birds cope with disease challenges. **Organic acids** are included for pathogen control, along with essential oils such as oregano. **Yeast products** offer immune stimulating properties, whilst **Probiotics** and **Prebiotics** support gut health.

Laying hen diets

Pullet rearing diets are formulated to make sure hens reach their genetic potential, whilst supporting good skeletal development. Uniformity is important for managing the flock, as is health status, so supporting immune development is key. To manage the birds changing requirements over time several different diets (three to four on average) are fed.

The newly hatched chick is only able to eat a small amount but has a lot of growing to do. At this time higher fat levels are used to produce an energy dense diet and encourage feed intake. Andrew Fothergill, national poultry advisor for BOCM PAULS explained that, "the birds should be at target weight all the way

through rear not just at the end, requiring attention to detail". As both they and their appetites grow the nutrient density of the diet is reduced. Pullet diets must also support development of the digestive tract, which is key to efficiency when laying. Martin Humphrey, Director of Feed Sales at Humphrey Feed, emphasised the importance of having 'fit not fat' birds at point of lay (POL). "Cheapness doesn't serve the market well in terms of grower diet – if you spend a bit more and you will get a more robust bird."

Laying diets need to reflect the hen's changing nutrient requirements but should be consistent in terms of the ingredients used. The first pre-lay diet will be relatively rich in protein in order to establish egg production, as well as supporting growth. Energy will also be higher at this stage to encourage feed intake and boost growth. "When pullets are transferred to the laying house, at approximately 16 weeks, is a critical stage in the birds life," Andrew re-iterated. "She has a nutrient requirement higher than her capacity to eat, as she is both growing and being encouraged to lay her first egg, which is a huge physiological change." The aim is to get to POL at the target time and start to produce saleable eggs.

At least four different diets are fed to the hen during the laying period, with up to eight used by some companies. Their strategy is to have smaller nutritional differences between the diets, to keep feed intake up and egg

production on target. Feed consumption changes from 90 grams per day when she arrives in the laying house to 120 or 130 at peak production. Once the hens are laying energy levels can be reduced and more in-soluble fibre included. And when she reaches her mature body weight, it needs to be controlled and a more stable plane of nutrition can be used. The aim is to feed enough so that she lays one egg a day. At the end of lay the priorities are to control egg size and ensure egg shell quality is as good as possible. The nutrient density of the diet is further reduced and calcium levels are increased in order to minimise seconds.

Being nutritionally aware

Martin Humphrey stressed the importance of, "knowing how your birds are coming on in rear – so you can have the right diets ordered for when they arrive at laying house". "Look at the performance compared to target to see if you will need to increase the nutrition. Or if they are at or above target then, particularly when it is hot, you may not want to upset the birds with dietary changes."

As the population grows food security and agricultural sustainability will become more important. With feed formulation and raw material selection playing an important role. "By-products can be considered cheaper options but utilising the nutrients they provide makes sense," re-enforced Andrew Fothergill. "All raw materials

have a worth but you need to know that worth is and use it appropriately," As more research is carried out and consistency improved they will become more attractive options.

It's not all about least-cost formulation however; limits are imposed on certain ingredients for both nutritional and functional reasons. For example too much oil in a diet would lead to a sticky mess but not enough and the mash will be dusty. Certain raw materials will be excluded from diets for young birds, whose digestive system aren't fully matured. Or an upper limit may be imposed to prevent a reduction in bird performance due to anti-nutritional factors.

This article focuses on the science behind feeding hens but there is also an art, particularly in the case of free-range production. "You need to be seasonally aware and know what's going on outside the house as well as inside," said Martin Humphrey.

Controlling egg size and number

Certain parameters are already set genetically in terms of egg size and number. Hens will produce 20-21 kilograms of eggs in a cycle no matter what you do. However, management and nutrition can manipulate the division of that production in terms of number and size of eggs. The rule of thumb is that if you increase average egg size by one gram, then you reduce the total number of eggs produced by five.

There is a natural cycle of eggs

starting small, then increasing in size and volume up to peak production before plateauing and finally decreasing in number whilst increasing in size. The heavier a hen is when she lays her first egg the larger it will be and the earlier she lays it the smaller it will be.

When egg production is consistently over 90 percent, egg size will stabilise. However, once it falls below 90 percent egg size will increase and surplus nutrients need to be removed to control it.

If the market requires large eggs then you should feed a high-energy diet until a stable body weight is reached. After which, energy should be reduced but protein level maintained to support egg production. If the number eggs are important, then nutrient availability should be reduced to control egg size. Protein levels shouldn't be in excess and energy should be provided at a level to maintain egg production and growth.

Diet Presentation

Chickens are naturally grain eaters, so presentation of the feed has a significant effect on consumption. However the diet is presented consistency and quality is important; for example minimising dust.

Crumbs are often used in starter diets (0-3/5 or even up to 10 weeks) to increase early feed consumption. It makes it easier for the birds to eat more in a shorter period of time and ensure they get a consistent blend in each beak full.

Mash is how most layers are fed; it is an efficient form that encourages the birds to eat for longer. This form also helps to develop the muscular walls of the gizzard and support digestion. The grist/particle size of the mash is important: too small and the birds can't pick it up, too large and they may be picked out; leading to an un-balanced diet.

Pellets may be fed to layers in certain circumstances. For example, if birds are not at target weight when arriving at the layer farm (particularly during summer), pellets may be used to encourage feed consumption and growth. They may also be used for organic diets, depending on ingredient availability, as oils can't be added; which can result in a very dry dusty mash. ■