

BASIC CONCEPTS OF BROILER AND LAYER NUTRITION

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The production of poultry meat and eggs represent some of the most intensive production systems which showed remarkable advanced development during the last few decades – a male bird can weigh up to 3 kg at 40 days of age and white egg layers can produce in excess of 330 eggs during 52 weeks of lay.

Poultry have an avian digestive system which consists of a crop, proventriculus, gizzard, small intestine and large intestine. Digestion is rapid due to a relative short digestive system with food particles remaining only approximately six hours in the system. When the chick hatches, it has a fairly undeveloped gastro intestinal tract that is also under developed in terms of healthy micro flora needed for effective digestion. Gut development takes place within the first 7 to 14 days, making the early access to feed and water very important

for successful development. The gut development process is also highly dependent on the quality and digestibility of the initial feed given to chicks. Poultry are unable to digest large amounts of crude fibre or roughage and therefore high roughage ruminant feeds are not suitable for poultry.

Well balanced protein sources like plant oilcake meals are necessary ingredients in poultry feeds. Protein consists of complex compounds which are digested into basic compounds. These amino acids are absorbed and converted into body tissues such as muscle (meat), feathers and eggs. Amino acid supplements enable the reduction in crude protein content of the diet by providing a more balanced protein profile in the diet. Lysine and methionine are the two first limiting amino acids. Grain, by-products, fat and oil are energy ingredients necessary for maintenance, growth, activity and production functions. Macro minerals are important to support growth, skeletal development, an effective immune system and also to maintain litter quality. Micro minerals are required for metabolic functions while vitamins are essential for health, growth and production functions. The major role of feed additives in diets are to serve as anti-coccidial agents, growth promoters, dietary pigments (colouring of egg yolk), pre-biotics, pro-biotics and enzymes to improve digestive functions, nutrient utilization and health.

Water is an extremely important nutrient to poultry. Therefore broilers and layers must always have free access to good quality clean drinking water. Water and feed intake are interdependent – reduced water intake can also lead to reduced feed intake. Environmental temperature also has an influence on daily water intake. When temperature exceeds 32 ° Celsius (C), water intake can be 30 to 50 percent higher than with temperatures of 20 to 25 ° C. A norm for daily water intake is that it should be between 1.5 to 2 times the daily feed intake.

Feed preparation can increase feed consumption and improve digestion, making the grinding of feed essential. Feed in mash form is suitable, but pellets and crumbles can increase consumption and feed efficiency. During formulation of different feeds, not only ingredient availability, but also limitations like quality, physical factors and anti-microbial factors are important. Mycotoxins in feed ingredients result in contaminated final feed with adverse effects like reduced efficiency of production and increased susceptibility to infectious diseases. Mould in feed or feed ingredients is mostly the precursor to mycotoxin contamination. The inclusion of mycotoxin binders in poultry feed is therefore a general practice.

To have various feed composition options, the Feedtek range of poultry concentrates for home mixing were developed to mix with a wide variety of protein and energy sources according to local availability and cost of these sources as well as to allow for any customer specific feed formulations and feeding circumstances.

The products contains the first limiting amino acids and all the minerals, trace minerals and vitamins required by the modern bird in the optimal level and ratio to each other. Feedtek has three concentrates including :

- Broiler Macro (medicated)
- Broiler Macro (medication free)
- Layer Macro

These concentrates have the following advantages :

- Highly concentrated to restrict transport cost
- Allow maximum use of local available feed ingredients
- Allow formulation freedom to include a wide range of raw materials
- Allow a range of different balanced feeds to be formulated according to production requirements
- Contain phytase enzyme to improve growth and feed conversion
- The medicated Broiler Macro contains two medicaments - a growth promoter and coccidiostat
- An alternative medicament free Broiler Macro is also available for the mixing of non-medicated broiler feeds

Phytase enzyme improve digestibility of calcium and phosphorous as well as that of amino acids in especially maize- and soybean based diets. In broilers, the increased nutrient availability for growth result in improved carcass yield.



BROILERS

Broilers are well known for their fast growth rate and require diets that can provide sufficient nutrients, in the correct ratio, to obtain rapid growth and the required feather development. As chickens grow, their daily feed intake increase. Energy requirements also increase relative to protein/amino acid requirements and therefore specific feeds need to be fed during the different growth stages. During the first two weeks, a lack of enzymes in the developing digestive system can result in poor utilization of many nutrients. The inclusion of enzymes in diets makes a contribution to overcome this restriction on optimum performance.

The optimal feeding stages of broilers are :

- Starter feed – first 7 to 14 days
- Grower feed – from day 7 to 14 until about day 28
- Finisher feed – from about day 28 until slaughter

Examples of home mixed broiler feeds with Feedtek Broiler Macro

Ingredients	Starter	Grower	Finisher
Maize meal	575	625	700
Wheat bran	66	66	66
Soybean oilcake meal	325	275	200
Feedlime	15	15	15
Broiler Macro (medicated)(*)	19	19	19
Total (kg)	1 000	1 000	1 000
Composition (g/kg)			
Protein	214	194	165
Lysine	12.5	11.1	9.1
Methionine	4.9	4.6	4.2
Energy (MJ/kg)	12.1	12.3	12.6
Calcium	9.9	9.8	9.5
Phosphorous	7.3	7.1	6.8
Phosphorous (Available)	4.1	4.0	3.8
Sodium	1.6	1.6	1.6

(*Replace the Broiler Macro (Medicated) with the Broiler Macro (Medication free) should non-medicated feeds be required, the remainder of the formulation stays the same)

For the gut to develop, chicks must start to eat as soon as possible after hatching, therefore seven day live weight is correlated to feed intake. Feed intake can thus be credited as the most important aspect of efficient broiler performance. Guidelines for feed intake and body weight of broilers are important and useful norms to calculate feed requirements and to compare performance.

Average body weight, feed intake and cumulative feed intake of broilers at different ages

Week	Average body weight (kg)	Average feed intake for week (kg)	Average cumulative feed intake (kg)
1	0.15	0.133	0.133
2	0.36	0.298	0.431
3	0.66	0.487	0.918
4	1.03	0.690	1.608
5	1.5	0.885	2.493
6	1.9	1.105	3.598
7	2.4	1.262	4.860

The typical feed conversion ratio (FCR) of broilers increases with age from 1.20 (week 1) to 2.60 (week 7) kg feed per kg live weight gain. Dressing percentage is in the order of 72 percent. Recommended feeding space should be 1.5 to 2.5 cm per chicken or one pan feeder per 40 to 80 chickens.

The physical form of the feed as well as pellet quality can affect feed intake and thus nutrient intake which in turn influences broiler performance. Crumbles or feed in mash form can be fed to about 15 days of age followed by pellets 3.5 to 4.5 mm in diameter.

Drinking water temperature should not exceed 25° C for day old chicks, in order to enhance immediate drinking of water and to prevent possible dehydration. The norm for drinking space is one round drinker per 60 to 100 broilers or one nipple drinker per 6 to 15 broilers.

An average stocking density guideline for ventilated houses is 20 to 25 broilers per square meter. Over-stocking lowers the potential for optimum performance and results in reduced growth, poor FCR and increased mortality. In open houses with no mechanical ventilation stocking density should preferably not exceed more than 10 broilers per square meter. The temperature in the housing environment should be close to 30° C at day one, going gradually down to 20° C at day 35. The uniformity of the spread of chickens within a broiler house gives a good indication of over- or under heating. During over heating, the chickens tend to spread out over the total floor space while they tend to flock together during circumstances of under heating.



LAYERS

The feed of layer pullets have to provide sufficient nutrients to maintain a growth rate that will result in reaching sexual maturity at a desired age, normally at 18 to 20 weeks. Layer pullets need feeds that are lower in protein (amino acids) and energy than that for broilers. Chickens reared for laying therefore have to receive different diets - a pullet starter from day old until 6 weeks of age (total intake $\pm$ 1.1 kg), a pullet grower from 6 to 12 weeks of age (total intake $\pm$ 3.2 kg) and a pullet developer from 12 to about 18 weeks of age (total intake $\pm$ 6 kg). The total feed intake until about 18 weeks of age is therefore 10.3 kg which can be much lower (about 8 kg) if actual lower dietary protein and energy needs of growing pullets are taken into account. At 18 weeks of age, the body weight of pullets should be between 1.3 to 1.6 kg.

If pullet starter and grower feeds are not readily available, the broiler grower feed can be fed to pullets from day old until 6 weeks of age and the broiler finisher feed to pullets from 6 to 12 weeks of age.

Layer feeds for egg production have to maintain hen body weight and also supply sufficient nutrients for efficient egg production. The intake of nutrients is defined by the nutrient levels in the feed. Nutrients are used for body maintenance, growth during the early laying cycle as well as egg production. Pullets must receive a layer diet for 7 to 14 days before the onset of lay at around 20 weeks of age to build sufficient calcium reserves. It is advisable to feed layers a high nutrient diet in the pre-peak laying period which is the period from 20 to about 30 weeks of age. The Layer 100 feed formulation is the ideal feed for this period. The Layer 115 feed is for adult grown out layers under normal feeding circumstances. During times of lower daily intake levels, for example during periods of heat stress, the Layer 100 feed with higher nutrient levels can be fed again for the applicable period of time to prevent a negative impact on egg production. Layer feeds are fed in mash form or as 3,5 to 4 mm pellets.

Examples of home mixed layer feeds with Feedtek Layer Macro

Ingredient	Pullet Developer	Pullet Pre-layer	Layer 100	Layer 115
Maize meal	640	600	600	600
Wheat bran	200	171	116	166
Soybean oilcake meal	125	175	175	125
Feedlime	16	35	90	90
Layer Macro	19	19	19	19
Total (kg)	1 000	1 000	1 000	1 000
Composition (g/kg)				
Protein	145	160	153	137
Lysine	7.1	8.3	8.0	6.8
Methionine	3.2	3.4	3.3	3.1
Energy (MJ/kg)	11.9	11.7	11.3	11.1
Calcium	10.4	17.3	37.0	37.0
Phosphorous	8.1	8.0	7.5	7.7
Phosphorous (available)	4.5	4.5	4.4	4.4
Sodium	1.6	1.6	1.6	1.6

The average daily feed intake of layers varies between 100 to 125 g per bird. A layer requires between 2.0 to 2.5 kg of feed for each kilogram of eggs produced. Typical egg weight is between 60 to 65 grams for large and extra large size eggs respectively. Over a 52 week production period, the daily feed intake averages around 105 g, equivalent to around 2.07 kg per dozen eggs laid. During a 60 week production period, feed intake is in the order of 1.5 kg per dozen eggs laid. FCR is about 2.2 to 1 and total egg production is about 300 eggs per annum.

The daily feed intake of layers will decrease with increasing temperature (above 27 ° C) with consequent effects on feed intake and egg production. Feed intake can decrease by as much as 20 percent when temperature increases from 24 ° to 35 ° C, accompanied with a negative effect on egg weight. With regard to stocking density, the optimum floor area is between 500 to 700 square cm per bird while 7 to 12 cm trough space is the norm for feeding space per bird. The recommended light period throughout the laying cycle is 14 to 16 hours. More hours of light will increase activity time and consequently feeding time and feed intake, which will result in increased body weight and egg size. This may have a negative effect on feed efficiency though.

WARNINGS

Due to the inclusion of medicaments in some feed, poultry feed must not be fed to horses.
Do not feed poultry feed to ruminants due to highly concentrated levels of certain nutrients.

For any queries on this article, please contact the author on 082 651 8958

Product registration numbers:

Broiler Macro Reg no (Act 36 of 1947) V24345
Layer Macro Reg no (Act 36 of 1947) V24346