OPINION LEADER

Practical Pullet and Breeders Nutrition: A nutritionist perspective from the field

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Abstract

Geneticists have done a remarkable job of selecting those families of broiler chickens that optimize performance and improve the efficiency of feed ingredients use. These changes have led to a remarkable reduction in the use of feed ingredients required to produce a broiler chicken. This has resulted in a significantly more sustainable production system. These improvements mean less agricultural land required, less fertilizer, less water, less diesel and electricity for production.

This improved efficiency, however, has resulted in more challenging pullet and breeder nutrition and feed management. Birds require less feed per unit of body mass gain, which means that the nutrient composition of the feed and uniform daily feed distribution to each bird has become more critical.

Todays Nutritionists need to understand the daily intake of all essential nutrients and ensure that they formulate a balanced feed that meets these needs using, high quality, highly digestible and readily available ingredients. They then need to work very closely with Breeder Managers to ensure that each bird receives their daily allocation through efficient feeding and housing systems.

Pullet and Breeder nutrition and management is one of the most challenging, but rewarding aspects of broiler production. Understand the daily nutrient needs of the birds, ensure they all receive what they need and you will be rewarded with exceptional performance and content chickens.

Introduction

Modern meat chicken breeding stock has been selected for extremely efficient conversion of feed into protein and rapid growth. The modern broiler breeders are also equally capable of producing more than 150 chicks per hen housed. As a result, it has become increasingly challenging to rear pullets and breeders to achieve the healthy chick numbers needed to supply the ever-expanding poultry meat market (Figure 1).

Multiple factors play an essential role in rearing healthy pullet and breeder hens and roosters. These include; proper housing, adequate lighting, efficient temperature and air control, health, animal husbandry, efficient nutrition and feed management.

Adequate pullet and breeder nutrition are essential to achieve target body weight, and body composition for reproduction, egg laying, and fertility. An even more important component of this is feed management. Feed management is critical to make nutrition effective in breeders. The nutritionist's job is to establish the correct balance of nutrients in the feed and then to work with breeder managers to ensure that each bird receives the required daily intake of nutrients for age.

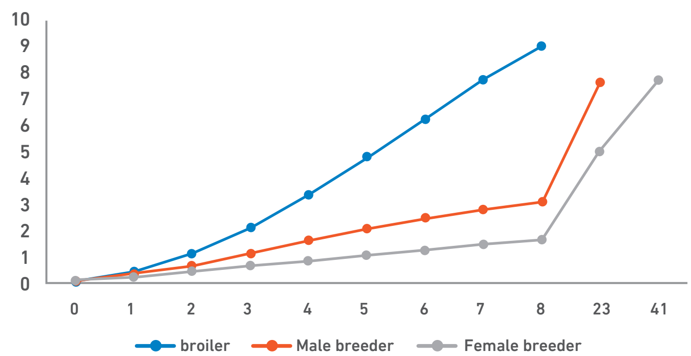


Figure 1. **Growth target for a male and female breeding stock compared to modern broilers for meat purposes.**

Role of Nutritionist for balanced feeding

Chickens, and particularly their digestive systems, like consistency. The nutritionist needs to design a feed with readily available, highly consistent, digestible, low-toxin ingredients. Once this has been achieved, the feed formulation should not be revised unless there is a change in ingredient nutrient composition or requirement of birds to meet the targets. Chasing a few pennies in formulation savings every other week ends up disrupting the uniformity of the feed.

Pullet and Breeder nutrition is mainly about effective feed management to provide proper nutrition to the birds. Nutritionists need to work with pullet and breeder managers to supply high-quality, consistent feed and discuss how to feed the birds. Changing feed composition and nutrients constantly means that managers have to re-learn how to feed their birds with every change.

How to set a nutrient composition for Pullet and Breeder feed?

Too often Nutritionists look to published works for the "correct or ideal" feed formulation to feed their breeding stock. Since we allocate feed on a daily basis or some other feeding program, formulation nutrient levels should be determined based on each operation's particular facilities.

The ability of the feeding system (rate of distribution, type of feeder, stocking density and feed program) will determine the uniformity of feed delivery to each bird.

Once it has been determined how much feed is needed to charge the system and evenly deliver feed, the energy density (bulkiness) of the feed can be set. With feed amounts and ME levels established, the amino acid and other nutrient densities can be calculated (Figure 2). Birds do not understand what % of the nutrient is in the feed but the amount of daily intake for their growth. A well-managed, efficient system with sufficient feeder space can feed a more nutrient-dense feed than a poorly designed and managed system. A daily feeding program requires a less dense feed than a skip feeding program.

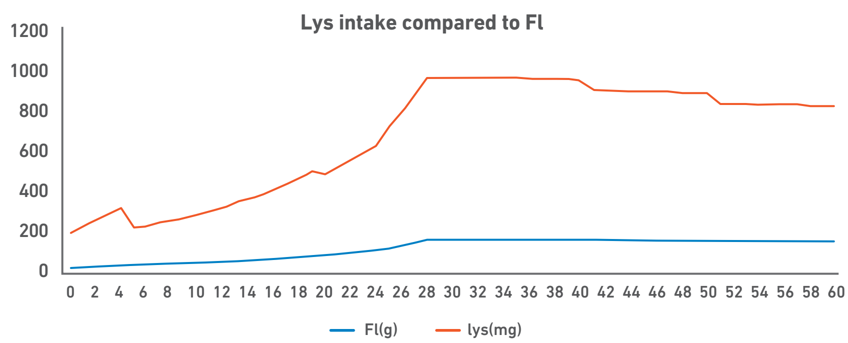


Figure 2. **An example of Feed intake (gm) and Lys intake(gm) in broiler breeder females throughout the age.**

(Source: Aviagen Parent Stock Nutrient Specification, 2021)

Using available resources to help set nutrient levels of feeds.

Primary breeder guides are a good place to start for nutrient levels. Primary breeders publish nutrients, feed amount, body weight and conformation guides. Unfortunately, due to the difficulty and expense of conducting breeding stock studies, there is very little useful or reliable published information. Genetic improvement is very rapid so most published work is dated or conducted with older breeds.

The procedure used by the author is:

1. Review available information
2. Evaluate housing and feed systems
3. Use actual feed intake, body weight and conformation measurements
4. Calculate daily ME intake based on feed amounts
5. Set amino acid, mineral and vitamin levels
6. Tabulate these values and plot them graphically to see the picture (Table 1).
7. Re-evaluate field performance by handling birds and reviewing the results.

Table 1. Daily nutrient intake per bird, assuming daily fed

						Feed Composition					Daily Nutrient Intake				
Week Age	Age Days	Avg.Weight Ross 708 lbs	Ross 708 gain per week	BW lbs	Daily Feed g/b/d	ME kcal/kg AVG	CP % AVG	dLys % AVG	dM+C % AVG	dThr % AVG	ME kcal/kg AVG	CP kcal/kg AVG	dLys mg/b/d AVG	dM+C mg/b/d AVG	dThr mg/b/d AVGt
0	-	0.08	-		16	2800	19.0	0.95	0.82	0.74	44	3.0	151	130	117
1	7	0.24	0.16		25	2800	19.0	0.95	0.82	0.74	70	4.7	237	205	185
2	14	0.47	0.23	0.50	29	2800	19.0	0.95	0.82	0.74	81	5.5	274	237	214
3	21	0.68	0.21	0.70	31	2800	19.0	0.95	0.82	0.74	87	5.9	296	256	231
4	28	0.88	0.20	1.10	33	2800	16.3	0.63	0.61	0.53	93	5.4	209	203	176
5	35	1.08	0.20	1.30	35	2800	16.3	0.63	0.61	0.53	99	5.8	223	216	188
6	42	1.28	0.20	1.50	38	2800	16.3	0.63	0.61	0.53	105	6.1	237	230	200
7	49	1.48	0.20	1.70	40	2800	16.3	0.63	0.61	0.53	112	6.5	251	243	211
8	56	1.68	0.20	1.90	42	2800	16.3	0.63	0.61	0.53	118	6.9	265	256	223
9	63	1.87	0.19	2.10	44	2800	16.3	0.63	0.61	0.53	124	7.2	278	269	234
10	70	2.07	0.20	2.30	46	2800	16.3	0.63	0.61	0.53	130	7.6	292	283	246
11	77	2.27	0.20	2.50	49	2800	16.3	0.63	0.61	0.53	137	7.9	307	297	258
12	84	2.47	0.20	2.70	51	2800	16.3	0.63	0.61	0.53	143	8.3	323	312	271
13	91	2.67	0.20	2.90	55	2800	16.3	0.63	0.61	0.53	154	8.9	346	335	291
14	98	2.87	0.20	2.97	58	2800	16.3	0.63	0.61	0.53	163	9.5	367	355	308
15	105	3.06	0.19	3.25	62	2800	16.3	0.63	0.61	0.53	173	10.0	388	376	327
16	112	3.30	0.24	3.55	65	2800	16.3	0.63	0.61	0.53	183	10.6	412	398	346
17	119	3.49	0.19	3.70	70	2800	16.3	0.63	0.61	0.53	195	11.3	439	425	369
18	126	3.8	0.26	3.80	74	2800	16.3	0.63	0.61	0.53	207	12.1	467	452	393
19	133	4.02	0.27	4.11	79	2800	16.3	0.63	0.61	0.53	220	12.8	495	480	417
20	140	4.32	0.30	4.45	83	2800	16.3	0.63	0.61	0.53	233	13.6	524	507	441
21	147	4.63	0.31	4.75	88	2800	16.3	0.63	0.61	0.53	245	14.3	552	534	464
22	154	4.95	0.32	5.00	93	2800	16.3	0.63	0.61	0.53	259	15.1	583	564	490
23	161	5.28	0.33	5.35	97	2800	16.3	0.63	0.61	0.53	272	15.8	612	592	514
24	168	5.61	0.33	5.61	102	2800	16.3	0.63	0.61	0.53	284	16.6	640	620	539
25	175	5.93	0.32	5.93	105	2800	16.3	0.63	0.61	0.53	295	17.2	664	643	559
										Comm	4181	246	9680	9288	8093

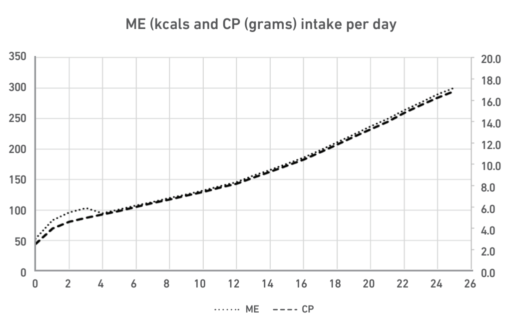


Figure 3. Daily intake of ME (kcals) and Crude Protein (grams)

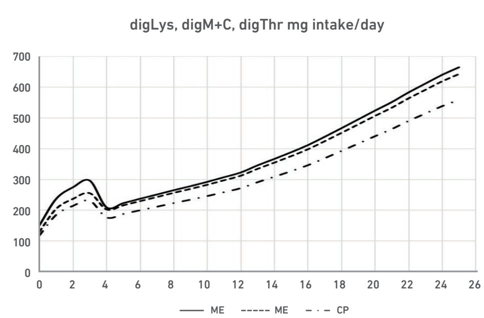


Figure 4. Daily intake digLys, dig M+C and digThr in mg/bird/day

The graphical representation highlights areas of concern. For example, in this scenario; digestible Lysine daily intake at 3 weeks of age is 296 mg/b/-day, after the feed is changed from Starter to Grower at +/- 21 days, daily intake drops to 209 mg/b/d, daily intake does not equal the 3-week intake level again until 10 weeks of age. This puts significant stress on the birds. The more aggressive birds will attempt to meet this daily intake by increasing feed intake. Any problem in feed distribution to the feed lines, feed space, etc can aggravate this. More aggressive birds will have higher feed intake. This could also lead to poorer uniformity in the flock, and increased feather licking, feather picking and cannibalism.

Anytime we have situations like this, it negatively impacts equal daily feed intake (daily nutrient intake). If these changes are large enough, the only option for the less dominant birds to try and meet their daily amino acid needs is to start eating feathers. They will start off eating floor feathers and then start pulling feathers, primarily the soft thigh feathers.

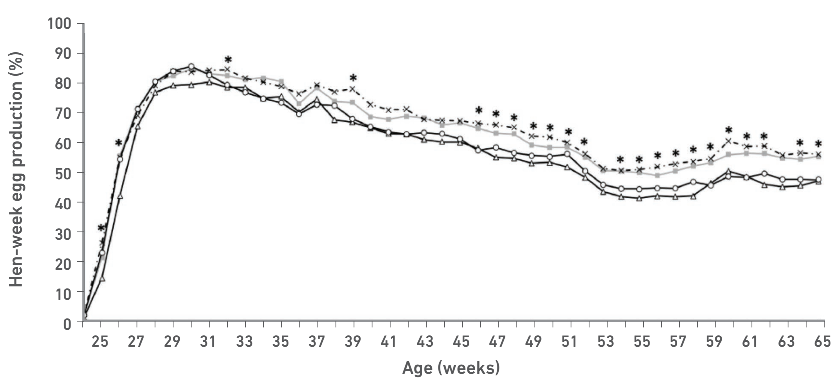
Too often the author hears “feed higher protein to improve feathering”, it isn’t about crude protein, it is about ensuring that correctly balanced nutrients are evenly distributed to each bird at every feeding. Too often increasing crude protein only exacerbates the problem.

Calorie intake in relation to amino acids

Due to genetically selecting more lean chickens and the efficiency of nutrient utilization, it is very difficult to deposit sufficient body fat on the birds needed for sexual maturity. Overfeeding amino acids (particularly lysine) results in over-fleshed birds with little or no fat reserves. Nutritionists should be routinely checking fat deposits on pin bones at 20 to 23 weeks of age. This together with fleshing and feathering will indicate whether or not they have the correct relationship of ME to amino acid balance.

The author has seen many programs where ME is lowered in the Grower feed to reduce calorie density in order to increase feed amounts to the birds. The amino acid density is not proportionally reduced, this results in high CP / amino acid intake. The author believes this is primarily b ecause nutritionists are afraid to feed a ±14% crude protein feed. Overfeeding of amino acids relative to calories results in over-fleshed birds, with no abdominal fat. The maintenance requirement for these birds is therefore higher and they will need higher daily nutrient allocations for the rest of their lives just to maintain this excess fleshing. Balancing the aa in the diet with calorie intake is important for proper growth and uniformity of pullets and breeders. Too high or too low in amino acid balance can affect performance, growth, egg production, and hatchability (Figure 5).

Treatments from 5 to 24 wk	Age (weeks)																						[1]HHEP Up to 65 wk
	25	26	30	39	46	47	48	49	50	51	52	54	55	56	57	58	59	60	61	62	64	65	
Low-AA	b	b	b	b	b	c	c	b	b	b	b	b	b	b	c	b	b	b	b	b	b	b	153.7[b]
Moderate-AA	a	a	b	ab	ab	ab	ab	ab	ab	ab	ab	a	a	ab	ab	a	ab	ab	b	ab	ab	a	174.3[a]
Standard-AA	a	a	ab	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	176.5[a]
High-AA	a	a	a	b	b	bc	bc	ab	ab	ab	ab	ab	ab	ab	bc	ab	b	b	b	ab	b	b	162.5[ab]



Birds were fed 80%, 90%, 100% and 110% of dietary amino acid levels of the Cobb-Vantress (2018) recommendation guidelines, guided by Lys using balanced protein during rearing. (Source: Oviedo-Rondon et al., 2021)

Figure 5. Hen weekly egg production (%) of Cobb 500 SF breeders from 24 to 65 weeks of age.

Lysine in the feed drives muscle accretion. The greater the excessive relative lysine in the feed, the more muscle protein accretion and therefore the higher daily maintenance requirement for energy and the other amino acids. Feeding higher CP diets with too much Lys content can create negative effects on weight gain, egg production, fertility, and hatchability in breeders.

In the past, lower limiting amino acids other than Lys, TSAA and Thr had to be balanced using the intact source of protein in feed ingredients. Increasing the lower limiting aa with an intact protein source would increase CP and Lys which would create more harm than good effects by increasing the lower limiting aa. With the availability of lower limiting amino acids, nutritionists have more opportunity to understand the functional benefit of lower limiting amino acids like branch chain amino acids, Tryptophan, and Arginine in the performance and welfare of birds without increasing crude protein like it would in the past.

In a normal USA standard diet, the level of Leu:Lys in breeder feed could easily reach over 145. Research in broilers have shown that increasing Leu level in the diet without the balance of Val or Ile could cause ruffled feather (Penz et al., 1985; Farran and Thomas 1992), bone deformities, Ca deposition in bones (Farran and Thomas 1992; Go et al., 2022), and impair performance and growth (Burnham 1992; Kidd 2021; Kriseldi 2022). Understanding and balancing the BCAA could lead to better performance and welfare of breeders.

Understanding the levels of lower limiting amino acids such as Tryptophan (Trp) in the diets could help to reduce aggressive behaviors in pullets and breeders. Dietary L-Trp could be a precursor to serotonin and modulate the serotonergic system through the hypothalamic-pituitary-adrenal axis (Shea, 1990).
Serotonin level has been demonstrated in numerous research studies that increase the calming effect and reduces aggressive behavior such as feather picking and pile-up (van Hierden et al., 2004; House 2021). Research has indicated that dietary L-Trp could improve serotonin production in birds and help with calming factors. Balancing the level of Trp in the diets based on the ingredients used could help with lowering the pile-up, reduce stress during off feed-days, and diminish feather picking and feather licking in birds.

Feeding Breeder females post peak

Many perfectly good breeders are damaged due to poor post-peak feeding practices. Inaccurate feed allocation, and nutrient densities post-peak result in higher or lower egg weight, increased/decreased weight, and not enough nutrient density to continue production and hatchability. Some of the post-peak feeding schedules adjustment are;

1. A set schedule of so many pounds/100 per day (grams/bird/day) – No two flocks have the same; body weight, condition, egg production, environment and activity. It looks good for benchmarking, but it isn't the best way to feed a breeder.
2. Adjusting according to weight – we sample and weigh a very small sample of birds in a house; the bigger, slower birds are generally the ones that are caught and weighed. Feed adjustments do not manifest themselves in the birds for 10 to 14 days, managers are continually chasing a moving target.
3. Weighing eggs – egg weight responds very quickly to over or underfeeding of nutrients. It is quick and easy, bulk weighs 120-150 eggs per day and plots the weights on a graph. Feed adjustments can be made timely and accurately.

Keeping track of the egg weights to update the nutrient management and feed allocation could be the best practice for feeding breeder females post-peak. Reducing the feed and nutrients for birds when they reach a specific age without other consideration could crash the birds sooner. Overfeeding or too dense diets in energy and amino acids can lead to large eggs and reduce hatchability and increase late mortality in meat-type breeders (Shafey, 2002; Figure 6).

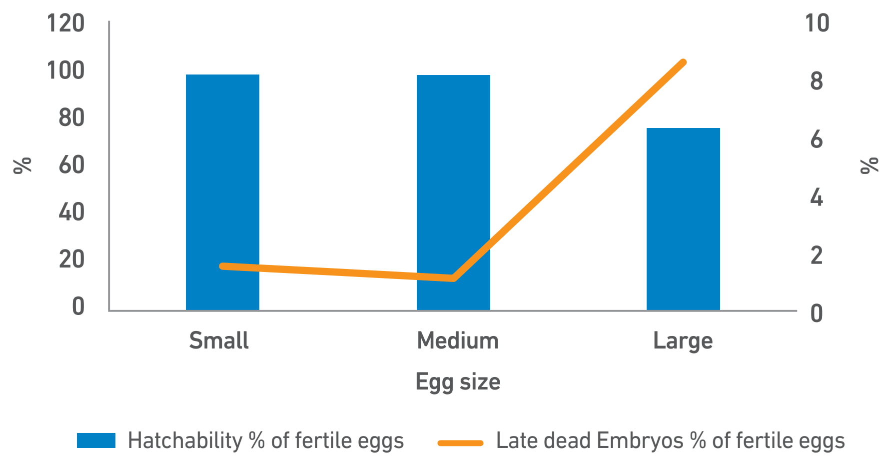
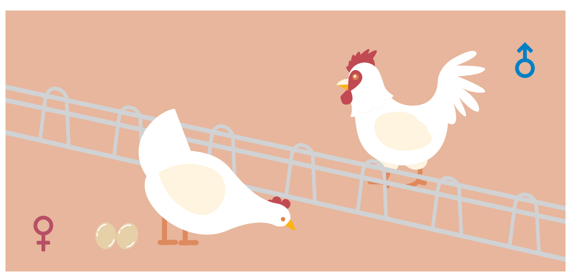


Figure 6. **Effect of egg size on the hatchability percent, late dead embryos of eggs from meat type (Hybro) breeders.**

(Source: Shafey, 2002)

Male feed management

Males are generally poorly managed. Most of the attention is focused on pullets and breeders; males are an afterthought. We do not have chicks without a fertile male. This is very apparent when we look at current hatch statistics.



Why are males and females still reared comingled?

1. They have very different growth profiles and behaviors.
2. Comingled flocks generally have poorer flock uniformity.
3. Feed cannot be correctly and evenly allocated to the birds.
4. It goes against every principle of good pullet and rooster rearing

Male weight, condition, and uniformity must be maintained in the layer house.

Testes of males that lose condition resorb and will not recover even if their condition and weight are restored.

Common problems are seen with male feeding;

1. Incorrect feed amount for level of mating activity and environment
2. Poor feeder designs, too deep, spacing too narrow
3. Feeder lines are not secure when lowered. A feeder line that tips will result in a 50% loss in available feeder space.
4. Uneven floors. Breeders like to dust bathe and will scratch shaving away from under feeder lines. Even out floors
5. Feeders are too high or too low. Measure feeder heights and observe the feeding. Not all roosters have the same shank length. Each flock needs to be observed and the feeder height set accordingly. Hens will feed at male feeders if they are too low.

Summary

Pullet, breeder, and rooster nutrition needs to focus on an equal daily intake of nutrients. The nutritionist needs to spend time in the field; observing, fleshing, weighing, and feather-scoring the birds. Proper breeder nutrition cannot be accomplished by sitting in an office running the least-cost formulations.

1. Determine the nutrient levels for each phase of growth.
2. Know the daily allocation of feed to meet those levels.
3. Find those ingredients that are readily available, and have a consistent composition and have good digestibility.
4. Don't change formulations for a few pennies or even dollars.
5. Understand and manage feeding systems, and support upgrading systems that allow more even feed distribution.
6. Work with breeder managers and people in the field to work with their system to provide the most complete nutrition to the birds.
7. Don't allow nutrition decisions to be mandated by benchmarking systems or accountants. They have never run a breeder or broiler study. They are not responsible for breeder performance, hatchability , or chick quality – YOU ARE.

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