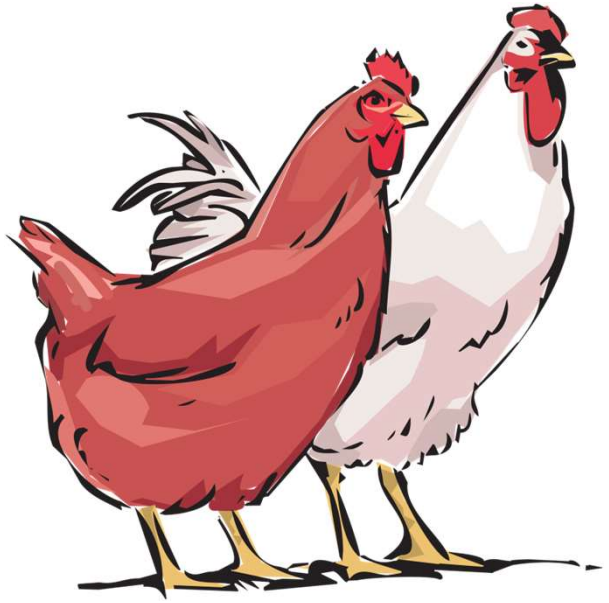
FUNDAMENTALS OF LAYER NUTRITION



By

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INTRODUCTION

1. Now-a-days poultry industry is a huge sector of our country to fulfil the protein requirement of human. The broiler and layer chicken are reared commercially in our country for meat and egg purpose.
2. To ensure the best quality and quantity of production from chicken we need to provide them accurate quantity of nutrition.
3. The intake of nutrients is defined by the nutrient levels in the feed and the amount of feed consumed.

Two factors must be taken into consideration during feed formulation in layer

1. Nutrient requirements
2. Information about feed ingredients

Nutrient requirements

Nutrient requirements based on the following factors

1. Feeding standards (NRC, ARC, ICAR, Strain specific and Customized)
2. Breed
3. Age (growth rate)
4. Stage of production
5. Environmental temperature

ENERGY SOURCES

1.Cereals (Maize, Rice, Wheat, Bajra)

2.Agricultural by-products (Rice polish or DORB)

3.Among cereals maize is preferred than other ingredients due

- Comparative energy cost /unit
- Structural difference in starch (more amylose content than rice)

Agricultural by-products

Particulars	Rice polish (Bran)	DORB
Moisture	9-10	<9
Oil	20-24	< 1
CP	12-13	14-16
CF	14	10-11
Ash	13-14	8-9
ME	3100	1600

Economic Importance of DORB

1. Price is less than bran
2. Contains more crude protein
3. Does not spoil for a long time

HOW TO IMPROVE THE UTILIZATION OF DORB

1. SSF Technology-Enhance the protein quality & digestibility by adding fungi (Rhizopus oryzae-a fast growing fungi that reproduce by means of hydrophobic sporangiospore that expand rapidly after maturation. This is approved by USFDA).
2. Exogenous enzymes supplementation: Major ANF is phytate, arabinose & xylose (Major NSP-unusable energy)
3. Supplementation of deficient nutrients-particularly addition of lysine and methionine

What is NSP (Non Starch Polysaccharides)

1. Extra-cellular or Cell wall polysaccharides, composed of different kinds of monomers, which are linked predominantly by β-glycosidic bond.
2. Providing rigidity and forming the fundamental structure of plant cell walls.
3. Cannot be degraded by endogenous enzymes

Major NSP contents in cereals (g /kg)

Ingredients	Soluble NSP	Insoluble NSP	Total NSP	Major NSP
Wheat	25	94	119	Arabinoxylan
Barley(Hulled)	45	122	167	B-Glucan
Oat (Hulled)	40	192	232	B-Glucan
Soya	27	16	192	Arabinoxylan & Galactorunans
Maize	3.29	66.1	69.30	Arabinoxylan
Rice	9	46.6	54.6	Arabinoxylan

Anti-nutritive effects of NSP

1. Change in digesta viscosity
2. Alteration in passage rate of digesta
3. Alteration in gut morphology
4. Alteration in gut physiology
5. Alteration in native gut microflora
6. Alteration in gut mucus layer

Amelioration of NSP

1. NSP degrading enzymes in poultry diet:

Various kinds of NSP-degrading enzymes include cellulase, hemicellulase, xylanase, pectinase, β-glucanase and α-galactosidase. βglucanase and xylanase have been successfully used in monogastric diets to hydrolyse NSP, such as barley β-glucans and arabinoxylans.

Besides, addition of NSP degrading enzymes during feed production was found to degrade NSP and markedly improved the digestion and absorption of feed components as well as performance.

2. Enzyme production: Various moulds, bacteria and yeast are used to produce enzymes. Among the microorganisms, most commonly used to produce enzymes are Aspergillus, Trichoderma and Bacillus

Microorganisms and enzymes produced by them

Types	Species	Enzymes
Fungi	Aspergillus niger	α- amylase, β- glucanase, Cellulase
	Aspergillus candidus	
	Aspergillus sydowi	
	Aspergillus oryzae	α- amylase, neutral protease
	Trichoderma viridae	Xylanase, β- glucanase, cellulase
Bacteria	Bacillus licheniformis	α- amylase
	Bacillus subtilis	α- amylase, neutral protease, β-glucanase

PROTEIN SOURCES

1. Conventional: Soyabean meal and different oil cakes (deoiled)

a) Among oil cakes sesame is safer than other oil cakes (high CF & Silica)

b) Rape seed cake can be used to certain extent (glucosinolates & erucic acid)

c) GNDOC can not be used higher level due to high mycotoxin contamination (due to high fibre content)

d) Oil cakes also have more tannin (decrease CP digestibility)

2. Unconventional protein sources (DDGS): Most of the protein sources are rich in Phytate

RICE DDGS

Comparative studies

Particulars	Market Rice DDGS	Original Sun dried rice DDGS
DM	91-92	90.57
CP	43-45	60.92
EE	4-6	4.68
CF	4.9-6.7	0.90
TA	6-8	8.85
AIA	2.5-4	3.12
GE	4000	4100
ME	2800	2850
Live Yeast	NA	High
Mycotoxin	High	NA
Digestibility	Low	High
Inclusion	5 % (max)	20%

Major Issues of Rice DDGS

1. High moisture
2. Nutrient variability
3. Reduced digestibility
4. Mould growth if not drying properly / prolonged storage
5. Adulteration

LOW PROTEIN IN LAYER FEEDS LEADS TO:

1. Greater feed intake (12-15%)
2. Less breast muscle (10-14%)
3. Higher abdominal fat (< 97%)
4. Delayed sexual maturity
5. Delayed production peak
6. Maintain higher level of production near the end of laying

PHYTATE

1. Salt of phytic acid
2. Phytic acid is formed due to combination of phosphate molecules with inositol (cyclic alcohol) with six hydroxy radicals
3. Only 30-35% phytate P is available to birds
4. Veg. protein sources like soya and oil seed cakes are the rich sources of phytate

ANTI NUTRITIONAL EFFECT OF PHYTATES

1. The antinutritional effects of phytic acid (0.7-1.4% in the diet) primarily relate to the strong chelating associated with its six reactive phosphate groups.
2. Phytate is negatively charged (anionic in nature).
3. Transitional trace minerals (Zn, Mn & Fe) are positively charged (cationic) in nature)
4. Both phytate and the transitional elements bind a complex and excreted via faeces
5. pH 6 is ideal for absorption of Zn & Mn in duodenum and upper jejunum
6. Neither Zn-Phytate or Ca-Zn-Phytate complex are absorbed under this pH

Amelioration of Phytate

1. Use of good quality phytase enzyme to reduce the negative effect of phytate
2. In high phytate content feed extra trace minerals to be added
3. Cooking of feed (pelleting)

Major Mineral:

Calcium:

Sources: LSP, LSG and Oyster Shell
Bioavailability: Oyster shell is more bioavailable than others
Inclusion: Chicks feed: LSP
Grower: LSP & LSG (1:1)
Layer: LSP &LSG (1:4)

Phosphorus:

DCP & MCP is the main sources for exogenous sources of Phosphorus
DCP of animal origin is more bio-available than rock origin
Animal protein sources can satisfy the P requirement if added at required level

TRACE MINERALS

Sources: Different salts of trace minerals as an inorganic sources and blend of amino acids as organic sources

Forms:Sulphate, Chloride, carbonate and oxide

There is no difference in production performance between organic and inorganic sources

Quality of organic TM is a big question due individual production, blending , quality assurance and assessment of assay

FEEDING SYSTEM

1. Whole grain
2. Grain & mash
3. All mash
4. Wet mash (during summer)
5. Pellet/ Crumble

- Among the above systems, crumble/pellet feeding showed promising result in terms of economics and performance

FEED STRUCTURE

- Mash feed is the most commonly used feed throughout the world. Layer hens tend to eat the larger particles avoiding the fine particle which is where most of the key nutrients are.
- Therefore, it is vital for successful nutrition to have a uniform particle structure. It is even more important in non-beak treated birds.
- Crumble and pellet forms can be used as long as the structure holds in the feeding system of the birds and it doesn't become a fine particle mash.

PHASE FEEDING

- To adjust nutrient intake in accordance with the rate of egg production

1. Phase I (from 19 wks to 45/46 wks)
   - Egg production increases from 0 to 97%
   - Increase body wt. from 1300g to 1600 g
   - Increase egg wt. from 40g to 56 g
2. Phase II (from 46 wks to 66 wks)
3. Phase III (from 67 wks to 85 wks)
4. Phase IV (from 86 wks to culling)

Nutrient Density & Egg Production

- Increase both ME & CP during summer season to fulfil all the nutrients needs within limited feed intake
- During winter Increase energy only to limit the protein intake (low energy feed>more feed and CP intake>increase egg size> decrease HD egg production & shell quality
- For optimum egg production and better shell quality : priority on energy and Calcium

Nutrient and Egg Size

- Level of Protein (14-17%) with balanced amino acids> heavier eggs
- Choice of protein (high methionine content oil cake-sesame> heavier eggs)
- Energy intake
- Minerals & vitamins level: Increase Ca & decrease Vit D > Decreased egg size
- Level of linoleic acid: Formation of lipoprotein in liver> ovary uptake by ova > higher egg wt.
- Stress

Nutrition & Egg Shell Quality

- Depends on presence of adequate level of vit D, Zn & P
- Deficiency related to decreased thickness, misshapen egg Failure & egg production
- Decrease Mn: Thin & brittle shelled eggs
- Very hot weather: poor shell quality
- Aged birds: Failure in Ca metabolism
- Sulphonamides & fungicides in grains: malformation of eggs
- Rancid oil in the feed: Rough shell
- Mycotoxin in feeds: Decreased Ca absorption> poor shell quality

INTERNAL EGG QUALITY

- Pale yolk: Due to addition of rice or bajra as major energy source
- Deep orange yolk: Due to presence of Xanthophyll & Zeaxanthine in maize. 10% inclusion of maize gluten meal will produce deeply orange yolk.
- Albumin & yolk ratio: Depends of CP & ME ration. Older birds the ratio of yolk is wider
- Blood spot: Insufficient vit A & K and presence of mycotoxin

FORMULATION TIPS

Condition -1 (Chick)

- Age: 5 wks, Body wt. 315 gm , Weekly gain: 80 gm Daily gain: 11.43 gm

- **Energy requirement (ME)**

Particulars	Formula	Required
Maintenance	$0.315^{0.75}$ x 83 x 100/82	42.55
Activity	42.55 x 0.37	15.74
Growth	11.43 x 0.18 x 4 + 11.43 x0.15 x 9	23.66
TOTAL		81.95

Feed requirement : 29.26 gm/ chick/day (Feed ME: 2800)

Protein requirement

Particulars	Formula	Required
Maintenance	2 x 0.315	0.63
Growth	11.43 x 0.18	2.057
Feather	11.43 x 0.07 x 0.82	0.656
TOTAL		3.217 (Protein efficiency 55%) CP= 6.078

Dietary CP will be : 6.078/0.2926=20.77 %

Condition -2 (Grower)

- Age: 12 wks, Body wt : 900 gm , Weekly gain: 65 gm
  Daily gain: 9.29 gm

- **Energy requirement (ME)**

Particulars	Formula	Required
Maintenance	$0.9^{0.75}$ x 83 x 100/82	93.53
Activity	93.53 x 0.37	34.61
Growth	9.29 x 0.18 x 4 + 9.29 x0.15 x 9	19.23
TOTAL		147.37

Feed requirement : 56.68 gm/ bird /day (Feed ME: 2600)

Protein requirement

Particulars	Formula	Required
Maintenance	2x 0.9	1.80
Growth	9.29 x 0.18	1.672
Feather	9.29 x 0.14 x 0.82	1.066
TOTAL		4.538 (Protein efficiency 55%) CP= 7.283

Dietary CP will be : 8.25/0.5668=14.58%

Condition -2 (Grower)

Age: 40 wks, Body wt : 1500 gm , Weekly gain: 14 gm

Daily gain: 2 gm

HD Production : 95% Egg Wt: 56 gm

Energy requirement (ME)

Particulars	Formula	Required
Maintenance	$1.5^{0.75}$ x 83 x 100/82	137.15
Activity	137.15 x 0.37	50.37
Growth	2 x 0.18 x 4 + 2 x0.15 x 9	4.14
Production	86 x 0.95	81.70
TOTAL		273,36

Feed requirement : 105 gm/ bird /day (Feed ME: 2600)

Protein requirement

Particulars	Formula	Required
Maintenance	2x 1.5	3.0
Growth	2 x 0.18	0.36
Production	6	6
TOTAL		9.36 (Protein efficiency 55%) CP= 17.02

Dietary CP will be : 17.02 /0.105=16.21%

CONCLUSIONS

1. For better production of layers, the various nutrients should be provided in accurate level.
2. Layers need different amount of nutrients in different stage of their growth and production.
3. Any types of nutritional imbalance can cause huge production loss or disease condition
4. So better nutrients supply lead to better growth and production of layers


THANK YOU