V H GROUP

BV300

Commercial White Egg Layer

SUPER FOOD

Nutrition and Management Guide

NOVEMBER- 2023

MAKE IN INDIA

In-house R & D Since 1981

Take care of your BV300 & She will take care of you

Hon'able Dr.A.P.J. Abdul Kalam during his visit to VRB

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INTRODUCTION

BV300 commercial white egg layer acquired the reputation of being the most adaptable, consistent, and prolific egg layer that maximizes profit margin in poultry farming. It is the result of continuous genetic research and development for over four decades at Venkateshwara Research and Breeding Farm Pvt. Ltd. (VRB) a group company of Venkateshwara Hatcheries Pvt Ltd. VRB is recognized by Department of Science and Technology. Government of India as an in-house R&D center since 1981.

However, the fruits of the finest genetic package of BV300 can only be fully expressed when the bird is provided with a balanced diet and good management. The information supplied in this publication is based on the analysis of extensive field results produced over time.

Warranty Disclaimer

The information supplied in this guide is presented as a service to our customers and should not be used as a guarantee or warranty of performance in any way. All the programs outlined in this guide are recommendations only and should be modified to match specific circumstances according to the situations.

1. 1 Evolution of the BV300

- The BV300 commercial white egg layer developed through the in-house R&D programme at Venkateshwara Research and Breeding Farm since 1981, made significant strides. The main goal was to develop a commercial egg-type chicken suitable for Indian agro-climatic conditions and farming practices through in-house research and development (R&D).

- To achieve this, the company invested in creating a full-scale breeding program of international standards and recruited dedicated R&D staff. The birds were raised in an environment similar to that of Indian farmers, and husbandry practices were aligned with commercial farm conditions in India. As a result of the interaction between the birds' genetics and the local environment, the chickens developed at Venkateshwara Research & Breeding Farm outperformed the imported stocks(Grand Parents) from North America and Europe, where the breeding stocks were raised in environment-controlled houses and fed high-energy diets.

- Being recognized as an in-house R&D center by the Department of Science and Technology, Government of India, is a testament to the company's dedication to innovation and scientific research.

- Furthermore, receiving an award from the Government of India for R&D efforts during 1994, is a notable achievement and indicates the impact and significance of the work. The fact that the BV300 commercial white egg layer is now well adapted to tropical agro-climatic conditions, husbandry practices and market requirements is another commendable feat.

- It suggests that the company has successfully developed a variety that meets the specific needs of the region.

1.2 Understanding the Components of Egg production costs.

The cost of producing eggs consists of various components.

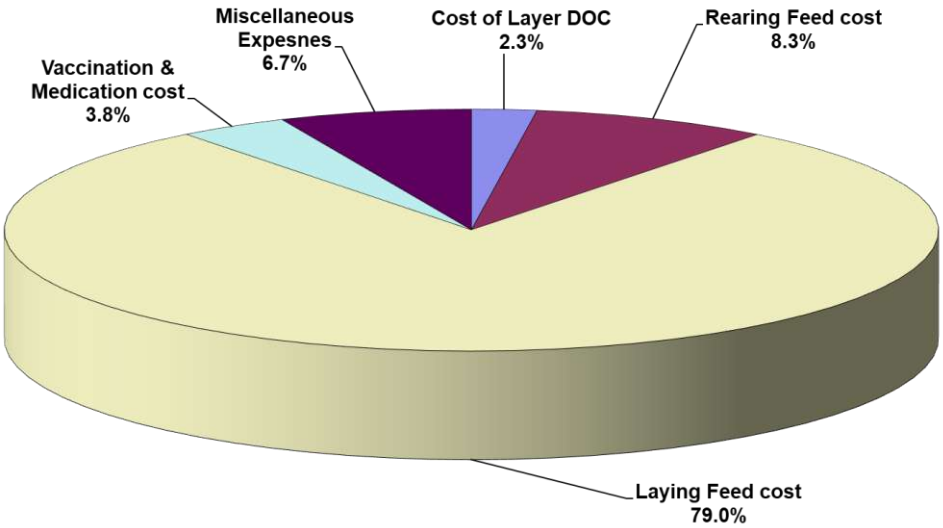
- One of the major components is the cost of feeding the chickens, which plays a crucial role in the profitability of the farm.
- The feed cost accounts for 8.3% during the rearing period and 79% during the laying period (figure 1, page 6).

To ensure a good profit in egg-laying operations, it is important to consider several factors.

- First, it is crucial to purchase high-quality feed ingredients at a reasonable price and at the right time. This helps in providing the necessary nutrition to the chickens for optimal egg production.

- Proper storage of the feed is also important to maintain its quality and prevent spoilage. This ensures that the chickens receive fresh and nutritious feed, which ultimately affects the quality and quantity of the eggs produced.
- Using cost-effective formulations for the feed is another important aspect. By formulating the feed in a way that balances nutrition and cost, it is possible to achieve economic efficiency and optimal performance in egg production.

Figure-1: Components of Egg production cost (100 week)



- The guide aims to provide information and guidance on these aspects, helping farmers make informed decisions about purchasing feed ingredients, storing feed, and formulating cost-effective diets for their chickens.
- Table 15 on page 33 in the guide serves as a useful reference for calculating the feed cost per egg. To calculate this cost at any given time, you will need to know the percentage of hen-day production, the amount of feed consumed per bird per day (measured in grams), and the feed rate (the cost of feed per kilogram in rupees).
- In addition to the feed cost, it's important to consider overhead costs in the overall cost of egg production. Typically, overhead costs are estimated to be approximately one-fourth of the feed cost per egg. By considering these overhead costs, you can have a more accurate understanding of the total expenses involved in egg production.

2. Basis of Nutrient requirements

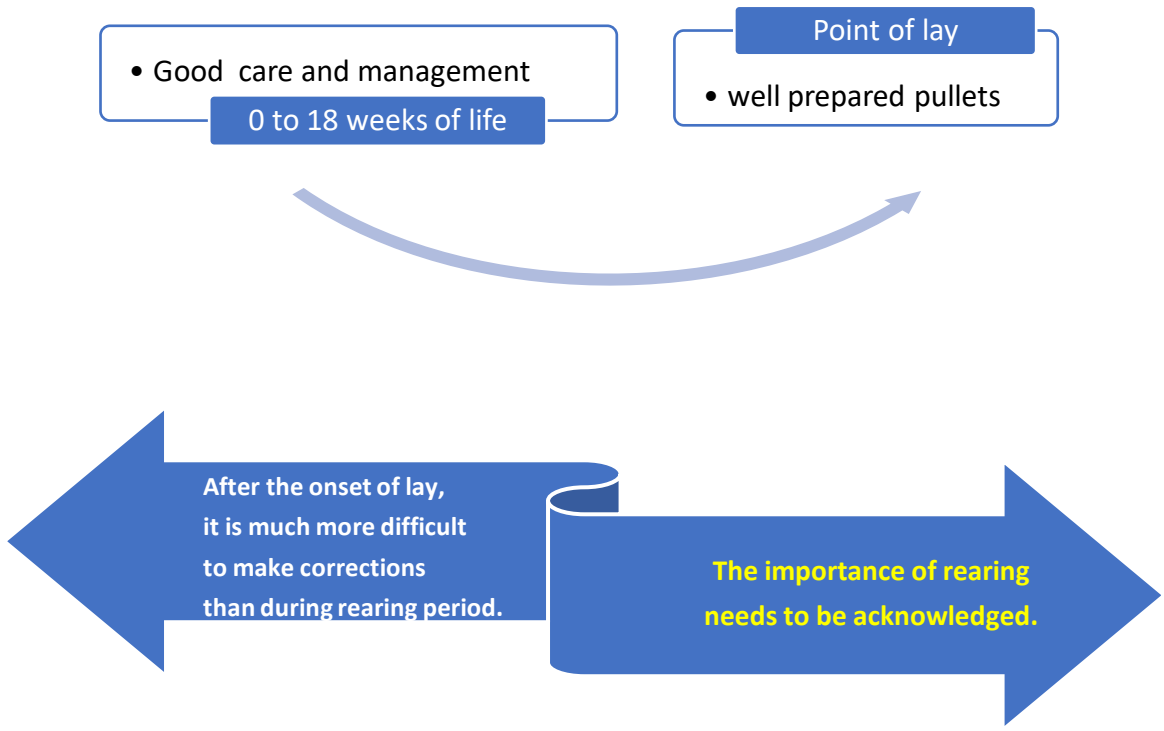
- The precise nutrient requirements for BV300 commercials for optimal results were determined after a thorough analysis of feed formulations, nutrient intake, and overall performance. Based on the gathered results, we have fine-tuned the nutrient requirements and compiled them into the BV300 Nutrition and Management Guide 2023.
- These requirements have been extensively tested in our own facilities, as well as on our customer farms, to ensure their effectiveness.

- By following these specifications, poultry farmers can achieve the performance goals outlined in Table 10 and 11, page 24 -26.
- The nutrient specifications provided in the guide are designed for the use of conventional ingredients, where nutrient digestibility can be reasonably predicted. However, in cases where non-conventional ingredients are utilized, it becomes crucial to formulate the diets with stricter standards of digestibility, particularly for digestible amino acids.
- For reference and practical implementation, the annexure section of the guide showcases examples of feed formulations utilizing various feed ingredients. These formulations can be found on pages 72 to 83, providing farmers with valuable insights and options for formulating their feeds.

3. *Rearing period*

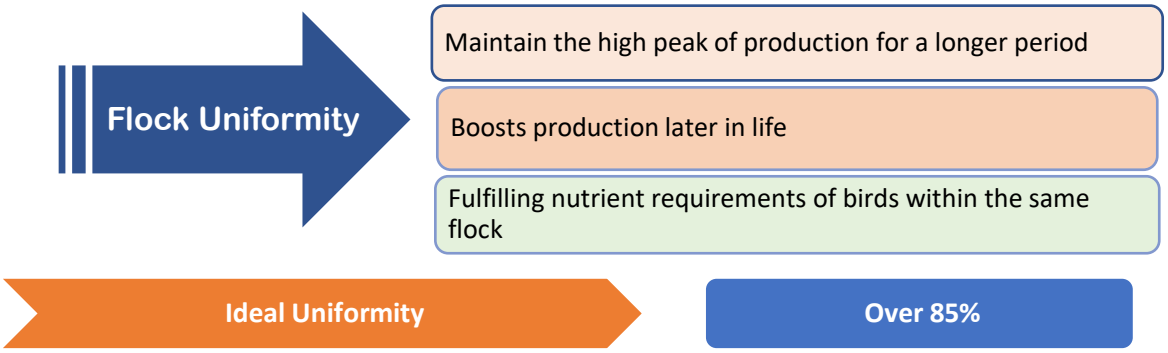
To get more eggs from hens

- You must build a better hen.
- A well-balanced feeding strategy, Lighting Program & Brooding/Growing management.
- Shifting/Transfer to laying shed before the onset of production.



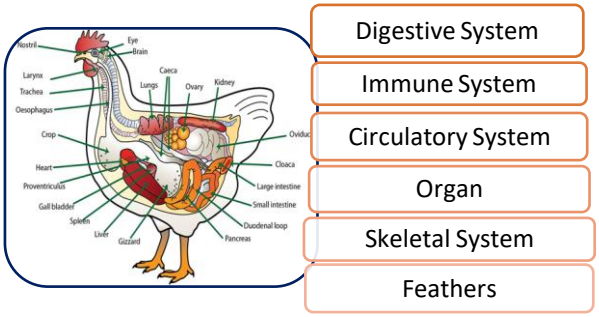
Flock uniformity

☞ One important aspect of rearing is the uniformity of pullets, which can either maintained or lost during rearing.



- The environmental conditions and housing systems can influence the nutrient requirements of pullets.
- In most cases, energy needs are influenced by management conditions, so it's important to adjust other nutrients based on energy levels.
- In hot climates, pullets eat less, so the amount of nutrients like amino acids should be increased accordingly.
- If pullets are grown on the floor instead of in cages, they tend to eat more feed, so amino acids can be reduced.

3.1 Chick Feed (up to 400g target body weight)



- Since their digestive system is still developing, it's important to provide them with highly digestible ingredients.
- Use good quality ingredients specifically reserved for preparing chick feed.
- During the first few weeks, pullets have a limited capacity for feed intake, so providing crumb-form feed helps them eat more.
- Maintaining proper brooding temperature, humidity, adequate space, ventilation, and water quality is crucial.
- Wait until the pullets reach the target body weight of 400g before switching to grower feed.
- If pullets don't reach the standard body weight, gradually increase the nutrient density.
- This period has the highest weekly growth rate and the best feed efficiency due to lower maintenance requirements. (Table 1 & Figure 2, page 10).

3.2 Grower Feed (400g to 750g body weight)

- Crumble feed is recommended to support continued growth and development.
- Grower feed has lower energy levels compared to chick feed to stimulate feed intake
- As pullets consume more feed, the amino acid density is reduced.
- Do not allow fine particles to accumulate.
- Ensure consumption of feed offered completely within 24 hours period.
- Shift to developer feed when pullets reach a target body weight of 750g.

3.3 Developer Feed (up to 14 days before the start of production)

- Developer feed has lower energy and protein levels compared to grower feed. This is achieved by increasing the fiber level to around 5 to 6%.
- It helps stimulate the development of the crop, gizzard, and overall gastrointestinal tract. If pullets are trained to eat during this period, it will help increase their feed consumption in the early laying period.
- Use 50% coarse limestone grit (2-3mm) and 50% fine limestone to develop the gizzard.
- A wider energy-to-protein ratio promotes fat pad development.

3.4 Pre-lay Feed (up to 0.5% production)

- During the 2-3 weeks before the first egg, significant physiological changes occur in the bird.
- Pre-lay diet and management are designed to allow the bird to build adequate reserves of medullary bone, which are necessary for eggshell calcification.
- The bird's skeleton contains calcium reserves in medullary bones that are continuously replenished and used for eggshell formation. If calcium intake is insufficient, the reserves may be taken from structural cortical bone, leading to issues like lameness.
- Pre-lay diets usually contain 2.2% calcium and are fed up to 0.5% production to allow calcium deposition in medullary bone.
- Start pre-lay feed when comb and wattle enlarge and turns red.
- Pre-lay feed helps in
    - transition from a low-calcium, low-nutrient-density developer feed to a high-calcium, high-nutrient-level diet.
    - It prevents reduced appetite and low feed intake during early egg production.
    - Proper use of pre-lay feed improves uniformity among pullets.
- 50% calcium should be provided in granular form (2-4mm diameter), and 50% in less than 1mm granule size.
- If pre-lay feed is not available, layer phase-1 feed can be given. The recommended nutrient specifications during rearing are provided in the table 2, page 11.
- Layer phase-1 feed can be started when production reaches 0.5%.

Table-1: Rearing performance objectives for BV300

Age		Cum Depletion %	Body weight				Feed Consumption per bird (g)			Crude Protein intake (g)/bird/day	ME intake(Kcal)/bird/day	Types of Feed
weeks	Days		Average (g)	Range (g)	Gain /week (g)	% Gain/ week	Average (Per day)	Range (per day)	Cumulative			
1	0 - 7	0.8	**65**	60-70	30	86	11	9-13	77	2.3	32	Chick
2	7 - 14	1.2	**110**	100-120	45	69	16	14-18	189	3.3	46	Chick
3	15 - 21	1.5	**165**	150-180	55	50	18	16-20	315	3.7	52	Chick
4	22 - 28	1.7	**235**	215-255	70	42	25	23-27	490	5.1	73	Chick
5	29 - 35	1.9	**315**	290-340	80	34	35	33-37	735	7.2	102	Chick
6	36 - 42	2.1	**400**	375-425	85	27	40	38-42	1015	8.2	116	Chick
7	43 - 49	2.3	**490**	460-520	90	23	44	41-47	1323	8.1	128	Grower
8	50 - 56	2.5	**580**	550-610	90	18	48	45-51	1659	8.9	139	Grower
9	57 - 63	2.7	**665**	630-700	85	15	49	46-52	2002	9.1	137	Grower
10	64 - 70	2.9	**750**	710-790	85	13	50	47-53	2352	9.3	140	Grower
11	71 - 77	3.1	**825**	780-870	75	10	51	48-54	2709	8.4	143	Developer
12	78 - 84	3.2	**890**	840-940	65	8	54	51-57	3087	8.9	151	Developer
13	85 - 91	3.3	**950**	900-1000	60	7	56	53-59	3479	9.2	148	Developer
14	92 - 98	3.4	**1000**	950-1050	50	5	58	55-61	3885	9.6	154	Developer
15	99 -105	3.5	**1050**	1000-1100	50	5	60	56-64	4305	9.9	159	Developer
16	106-112	3.6	**1105**	1050-1160	55	5	62	57-67	4739	10.5	161	Pre-lay*
17	113-119	3.7	**1170**	1110-1230	65	6	63	58-68	5180	10.7	164	Pre-lay
18	120-126	3.8	**1240**	1180-1300	70	6	66	60-72	5642	11.2	172	Phase-1**

* 14 days before onset of production. ** Start phase-1 from 0.5% Hen Day Production.

- ☞ Feed consumption varies depending on housing density, ambient temperature, feather cover, lighting programme and flock health as well as caloric density of the feed.
- ☞ Feed density should be adjusted to compensate for a reduction in feed consumption due to abnormal, stress conditions.
- ☞ An actual body weight below the minimum for any age indicates the need for increasing feed consumption and nutrient fortification.

Figure 2: Standard body weight, weekly gain, and weekly per cent gain up to 18 weeks.

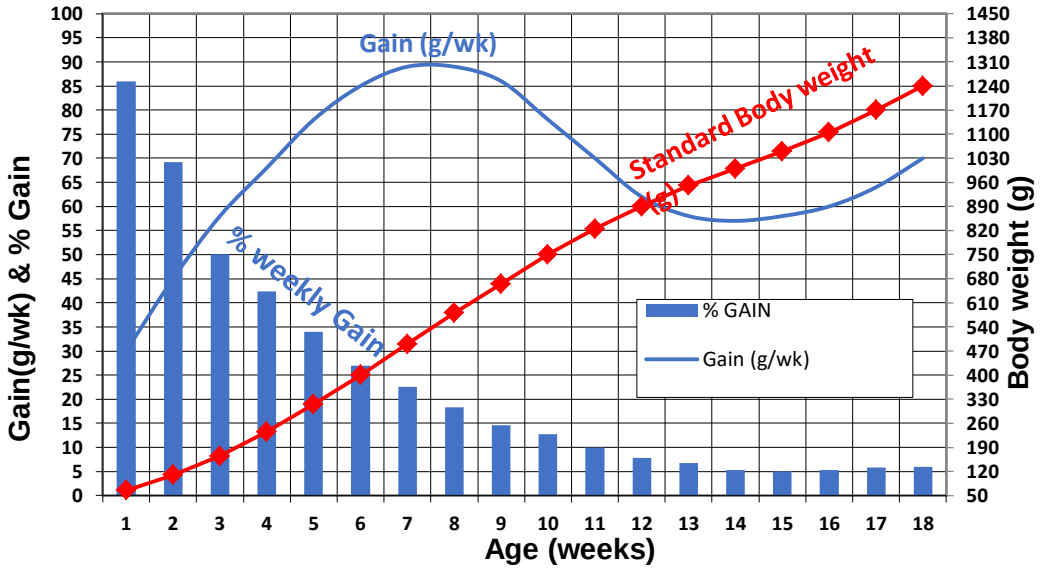


Table-2: Rearing period Nutrient Level Recommendations for BV300

Feeding phases		Chick	Grower	Developer	Prelay*
Feed up to		400g body weight	750g body weight	10 days before onset of production	0.5% daily egg production
Nutrient	Units				
Metabolizable Energy (min)	Kcal/kg	2900	2850	2700	2700
Crude Protein	%	20.50	18.50	16.50	17.00
Crude Fiber	%	3.50	4.0 – 5.0	5.0 – 6.0	4.5 – 5.5
Ether extract	%	3.5 – 5.5	3.0 – 4.5	3.0 – 4.0	3.0 – 4.5
Total Lysine	%	1.12	1.00	0.80	0.84
Total Methionine	%	0.54	0.48	0.41	0.44
Total Methionine + Cysteine	%	0.85	0.78	0.70	0.73
Total Threonine	%	0.79	0.71	0.62	0.63
Total Tryptophan	%	0.24	0.22	0.20	0.20
Total Arginine	%	1.30	1.20	1.05	1.08
Total Isoleucine	%	0.83	0.75	0.64	0.66
Total Valine	%	0.92	0.85	0.78	0.78
Dig. Lysine	%	1.00	0.90	0.70	0.73
Dig. Methionine	%	0.50	0.45	0.38	0.41
Dig. Methionine + Cysteine	%	0.76	0.70	0.60	0.64
Dig. Threonine	%	0.67	0.60	0.49	0.51
Dig. Tryptophan	%	0.20	0.18	0.16	0.16
Dig. Arginine	%	1.18	1.08	0.84	0.88
Dig. Isoleucine	%	0.74	0.67	0.56	0.59
Dig. Valine	%	0.81	0.75	0.67	0.67
Calcium	%	1.05	1.05	1.05	2.20
Available Phosphorus	%	0.48	0.46	0.42	0.42
Sodium	%	0.20	0.18	0.18	0.18
Chloride	%	0.20	0.18	0.18	0.18
Potassium	%	0.92	0.87	0.86	0.84
Linoleic Acid	%	1.50	1.30	1.25	1.50

*Introduce the pre-lay feed 14 days before the start of egg production, when most pullets show signs of comb enlargement and reddening.

Change the feed when the pullets reach the recommended target body weight or production level.

Avoid changing the feed before an anticipated stress events like beak trimming or transfer, or immediately after such events.

Introduce the Phase I feed no later than when daily egg production reaches 0.5%. The pre-lay feed does not provide enough calcium for the laying bird's requirements. If the flock has been light stimulated, avoid feeding the pre-lay feed for more than 1 week.

In the developer and pre-lay diets, ensure that 50% of the added calcium source is in the form of granules with a size of 2-4 mm to promote gizzard development.

The maximum chloride level in the diet should be 0.20%.

If growth is slower than expected, increase the nutrient density in the diet

Make suitable modifications in the feed depending on environmental conditions and market requirements.

4.0 Laying Period

The feed during the laying period must meet the birds' requirement for

- ✓ Maintenance
- ✓ Production
- ✓ Growth

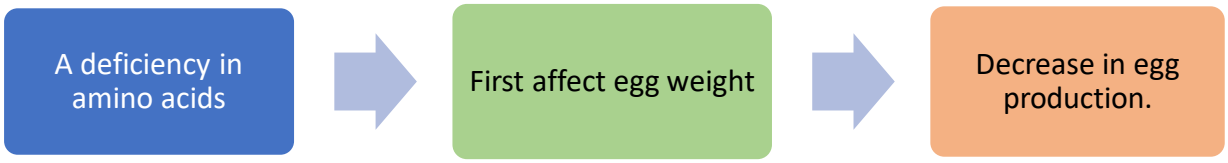
Goals during Laying Period	Promoting immunity for better livability.
	Achieving marketable egg size quickly
	Achieving high production peaks
	Maintaining persistent production over extended periods
	Controlling egg weight
	Maintaining shell quality

Each phase of the feed is specifically designed to fulfil the requirements for maximum egg production and optimum egg weight.

Consumption-based formulations can be used throughout the year by selecting appropriate feed consumption levels.
Feed consumption is influenced by

- body weight,
- performance,
- house temperature,
- feed texture,
- energy level of the feed,
- nutrient imbalances in the diet.

If there is a deficiency in certain nutrients, the hen may try to compensate by increasing feed consumption.
Birds are sensitive to new ingredients, so it is important to gradually introduce any changes.



Phase feeding

- An optimized feeding regimen for flocks is structured based on the age of the birds, rather than focusing solely on production with respect to calcium and phosphrous requirements.
- The feed supplied is carefully formulated to contain all necessary nutrients to support 100% production of individual birds in all phases.

The following are the reasons for implementing four-phase feeding approach.

1 Decreased amino acid requirement

- Once the bird reaches its mature body weight, there is a decrease in the requirement for amino acids by approximately 7%.
- Through phase feeding, we can prevent excessive intake of nutrients, leading to substantial savings in feed costs without compromising production

2 Minimizing the effects of aging

- By adapting the feed composition to the specific age of the birds, the negative impacts of aging can be minimized.

3 Calcium absorption

- Calcium absorption reduces with increasing age

4 Reduced ability to transfer calcium

- The ability to transfer calcium from medullary bones reduces with increasing age.
- This necessitates increases in the calcium content of the feed periodically like 31 weeks, 56 weeks, and 81 weeks.

5 Adjusting phosphorus levels

- As birds age and their ability to transfer calcium decreases, their phosphorus requirement decreases as well.
- Excessive serum phosphorus levels can negatively affect calcium absorption. Consequently, phosphorus levels in the feed are reduced during the afore mentioned periods.

6 Minimizing thinning of eggshells

- With the age when egg weight increases, the shell mass do not increase, and the shell becomes thin.
- This can be minimized if the egg weight increment is minimized.
- This is possible in phase feeding by reducing protein periodically without affecting production.

7 The impact of egg weight on feed consumption

- when the egg weight increase by 1.6 gram, the hen needs to consume an additional 1.0 grams of feed.

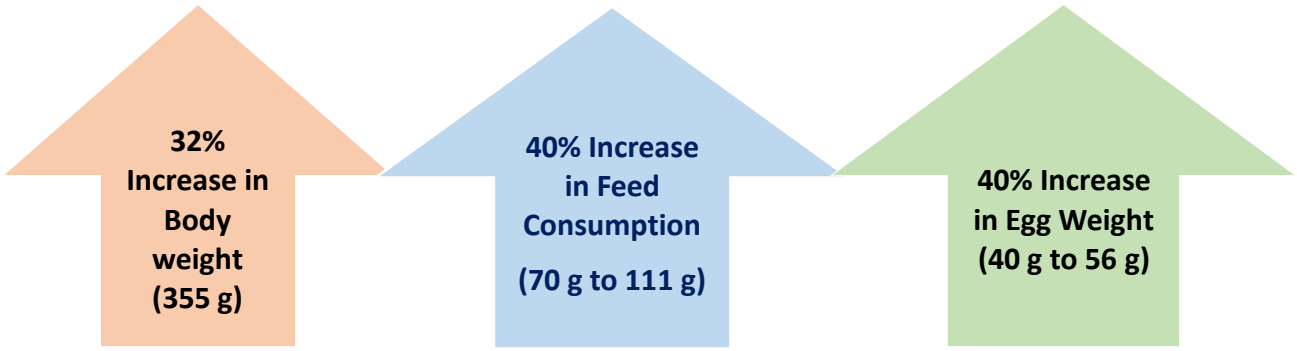
8 Better nutrient alignment

- Phase feeding ensures that the nutrient requirements closely match the birds' needs.
- This approach optimizes cost efficiency without affecting production.

9 Enhanced shell quality and feed efficiency

- By implementing phase feeding during extended laying cycles, it becomes possible to maintain better shell quality while also improving feed efficiency through controlled egg weight, all without negatively impacting production.

4.1 Phase-1 (0.5% egg production to 30 weeks)



- ✓ Maximum nutrient demand is in this period.
- ✓ Production reaches peak.
- ✓ However, feed consumption is low as birds are yet to reach mature body weight.
- ✓ Some managemental efforts to increase feed consumption are:
  - Increase day length by providing artificial light when body weight is 1.2kg or 10% production whichever earlier.
  - Frequent feeding.
  - Early morning feeding.
  - Avoid accumulation of less fine particles in the feeders
  - Mid-night light
- ✓ The goal in this phase is to attain body weight targets and mature body weight. This indicates adequacy of the given diet.
- ✓ If targets are not met review the formulation and make required changes.
- ✓ The feed consumption in this phase is about 8.43kg.
- ✓ Consumption based nutrient levels are given in page 19 (table 4).

4.2 Phase-II (31 to 55 weeks of age)

- ✓ By 30 weeks of age, body weight growth becomes minimal, and the production and egg weight curves flatten.
- ✓ Therefore, the amino acid requirements of the birds decrease at this age.
- ✓ It is appropriate to transition to the second phase with a reduction in amino acids.
- ✓ Energy levels are also reduced to encourage feed consumption.
- ✓ Additionally, feed consumption increases as birds have attained their mature body weight.
- ✓ The Phase-II feed is significantly less costly compared to the Phase-I feed.
- ✓ This phase is designed to maintain body weight and egg weight with minimal increments while sustaining egg production with minimal fluctuations and reducing feed costs.
- ✓ The best indicators of excess or insufficient nutrient intake are egg weight, body weight, and production. Close monitoring of these parameters is necessary.

- ✓ Depending on feed consumption, the formulation within the phase may be adjusted to maintain production and save on feed costs.
- ✓ Following changes are recommended in phase II feed as compared to phase I.

Decrease in	Increase in
Energy(oil) by 50 Kcal	Calcium by 0.2%
Lysine by 30 mg	
Avialable Phosphrous 0.02%	

- ✓ Consumption-based nutrient levels can be found on page 20 (Table 5).

4.3 Phase-III (56 to 80 weeks age)

- ✓ Transitioning to this phase is an economical decision.
- ✓ Shift to Phase III feed when daily egg mass production starts to decline or when control over egg weight is desirable.
- ✓ Further reductions in energy, amino acids, and available phosphorous, along with an increase in calcium, are recommended (Table 3, page 18).
- ✓ Consumption-based nutrient levels can be found on page 21 (Table 6).

4.4 Phase-IV (81 weeks and above)

- ✓ Feed intake does not decrease with age, but there is a drop in daily egg mass produced by the bird over time.
- ✓ To control egg weight and compensate for the decline in egg mass, further reductions in amino acids and available phosphorous should be made, accompanied by an increase in calcium.
- ✓ Consumption-based nutrient levels can be found on page 22 (Table 7).

☞ *Recommended Calcium source size in different phases of feed*

Phases	Phase I	Phase II	Phase III	Phase IV
*Fine % (up to 1 mm)	50	40	30	30
Coarse % (2 to 4 mm)	50	60	70	70

*Fine calcium source should be granular

4.5 Change from one phase to another

The transition from one feed type or phase to another should be done gradually.

Within a week do not decrease	• Protein intake by more than 0.5g/bird/day • Energy level by 50 Kcal/kg

Methods for changing feed		
Calculate the total feed consumption of the flock		
	Current Feed	**New Feed**
Day 1 to 3	75%	25%
Day 4 to 6	50%	50%
Day 7 to 9	25%	75%
Day 10 onwards	0%	100%

4.6 Ad Libitum feeding

- ✓ Ad libitum feed is recommended during both the rearing and laying periods.
- ✓ Allowing the birds to adjust their intake according to the nutrient density of the feed is important.
- ✓ Restricting feed intake may negatively impact flock uniformity, performance, and can lead to health issues.

4.7 Crude Fiber

Crude fibre (insoluble non-starch polysaccharides) may not have nutritional values for poultry, but it is important for a healthy and stable digestive physiology.

In Grower & Developer Feed, it can positively influence the development of digestive tract, crop size, gizzard, and the appetite of the pullets.

A minimum recommendation of crude fibre (5 – 6%) in the developer feed.

Cereals and oil seed by-products can be used as source of crude fibre. However, their inclusion should not reduce energy level of the diet

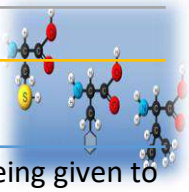
Cereal by-products (bran) have a fine structure and have limited effects on gastrointestinal movements, making them less suitable as a fiber source

Sunflower and rapeseed meal are recommended source of insoluble fibre.

4.8 Amino acid

Digestible Amino Acid based formulations are close to the bird's requirements

They are economical because they reduce the unnecessary safety margins.



They assess the raw materials according to their true biological value.

Formulation according to total amino acids leads to the same nutritional value being given to all raw materials irrespective of their digestibility.

The amino acid concentration of the diet depends on daily egg mass produced and daily feed consumption.

If diet formulations are based on recommended ideal amino acids ratios, the birds get balance protein and they achieve performance objectives.

Table 13 on page 31 provides information on the digestible amino acid composition of feed ingredients. Ideal amino acid ratios are given in table 8, page23.

4.9 Enzymes

- The use of phytase enzymes is common and proven. It reduces the need for available phosphorous inclusion in the feed, thereby reducing the cost. It also has environmental benefits by reducing phosphorous excretion.
- Xylanase enzyme inclusion aids in the digestion of non-starch polysaccharides (NSP).
- Protease enzymes improve protein digestibility, allowing for reduced inclusion levels and reduced nitrogen excretion.
- The manufacturer's recommended matrix levels can serve as guidelines and can be fine-tuned based on experience. Enzymes act by reducing gut viscosity, increasing digestibility and nutrient absorption, and reducing pathogenic populations in the hindgut.

4.10 Emulsifiers

- Young birds are not efficient at digesting fat present in the feed.
- Adding emulsifiers along with antioxidants improves fat utilization and promotes growth and feed conversion.

4.11 Vitamins and Minerals

- Refer to Table 9 on page 23 for the recommended vitamins and minerals for rearing and laying feed.
- Using high-quality vitamins and minerals is essential for achieving performance objectives.

4.12 Feed Ingredients

- Table 12 (page 30) provides nutrient composition information for feed ingredients, which can serve as a guideline.
- However, each feed manufacturer should analyze the ingredients used and develop their own nutrient matrix for more accurate results.
- Nutrient composition information is available for some commonly used and safe ingredients, but not all.

4.13 Feed Consumption estimate

- For intake-based feed formulation, the feed consumption per bird per day is required. If this information is not available, it can be estimated (table 14, page 32).

Table-3: Recommended Laying Period Nutrient Requirements for BV300

Nutrient	Unit	Phase-I From 0.5% production until 30 weeks age	Phase-II 31 to 55 weeks age	Phase-III 56 to 80 weeks age	Phase-IV 81 weeks above age
Metabolizable Energy	Kcal/kg feed	2650	2600	2550	2500
Crude Protein	g/day	17.0	16.75	16.50	16.0
Crude Fiber (minimum)	%	4.0 – 5.5	4.5 – 6.0	4.5 – 6.0	4.5 – 6.0
Ether Extract (minimum)	%	3.0 - 3.5	2.5	2.0	2.0
Total Lysine	g/day	0.850	0.820	0.785	0.750
Total Methionine	g/day	0.480	0.440	0.400	0.380
Total Meth. + Cysteine%	g/day	0.750	0.710	0.660	0.630
Total Threonine	g/day	0.63	0.61	0.58	0.56
Total Tryptophan	g/day	0.19	0.18	0.17	0.16
Total Arginine	g/day	1.07	1.04	0.99	0.94
Total Isoleucine	g/day	0.67	0.64	0.61	0.58
Total Valine	g/day	0.77	0.74	0.72	0.69
Dig. Lysine	g/day	0.750	0.720	0.685	0.650
Dig. Methionine	g/day	0.450	0.410	0.380	0.350
Dig. Meth. + Cysteine	g/day	0.675	0.635	0.590	0.550
Dig. Threonine	g/day	0.53	0.50	0.48	0.45
Dig. Tryptophan	g/day	0.17	0.16	0.15	0.14
Dig. Arginine	g/day	0.82	0.79	0.75	0.72
Dig. Isoleucine	g/day	0.60	0.57	0.53	0.50
Dig. Valine	g/day	0.68	0.66	0.62	0.60
Calcium	g/day	4.00	4.20	4.40	4.60
Av. Phosphorus	g/day	0.40	0.38	0.32	0.30
Sodium	g/day	0.18	0.18	0.18	0.18
Chloride	g/day	0.20	0.20	0.20	0.20
Potassium	g/day	0.78	0.77	0.76	0.75
Linoleic Acid	g/day	1.20	1.20	1.10	1.00

☞ Ensure compliance with the listed requirements for all digestible amino acids in the table. The crude protein value may vary depending on the inclusion of non-conventional protein sources.

The nutrient profile will vary when feeding different energy levels.

Make appropriate modifications based on environmental conditions and market requirements.

The maximum chloride level in the diet should not exceed 0.20%.

Phase feeding and intake-based formulations are beneficial to meet the birds' daily nutrient requirements more closely.

For information on the addition of fine and coarse calcium carbonate sources for different phases, please refer to page 15.

Table-4: Consumption based Nutrient Levels for BV300: Phase - I

From 0.5% production to 30 weeks age						
Nutrients	**Unit**	**Daily Feed Consumption per bird (g)**				
		90	**95**	**100**	**105**	**110**
Metabolizable Energy	Kcal/kg	2650	2650	2650	2650	2650
Crude Protein	%	18.9	17.9	17.0	16.2	15.5
Crude Fiber (min)	%	4.5	4.5	4.5	4.5	4.5
Ether Extract (min)	%	3.0	3.0	3.0	3.0	3.0
Total Lysine	%	0.95	0.90	0.85	0.81	0.77
Total Methionine	%	0.53	0.50	0.48	0.45	0.43
Total Meth + Cysteine	%	0.83	0.79	0.75	0.71	0.68
Total Threonine	%	0.70	0.66	0.63	0.60	0.57
Total Tryptophan	%	0.21	0.20	0.19	0.18	0.17
Total Arginine	%	1.19	1.13	1.07	1.02	0.97
Total Isoleucine	%	0.74	0.70	0.67	0.64	0.61
Total Valine	%	0.85	0.81	0.77	0.73	0.70
Dig. Lysine	%	0.83	0.79	0.75	0.71	0.68
Dig. Methionine	%	0.50	0.47	0.45	0.43	0.41
Dig. Meth + Cysteine	%	0.75	0.71	0.67	0.64	0.61
Dig. Threonine	%	0.58	0.55	0.53	0.50	0.48
Dig. Tryptophan	%	0.18	0.17	0.16	0.16	0.15
Dig. Arginine	%	0.92	0.87	0.82	0.79	0.75
Dig. Isoleucine	%	0.67	0.63	0.60	0.57	0.55
Dig. Valine	%	0.76	0.72	0.68	0.65	0.62
Calcium	%	4.44	4.21	4.00	3.81	3.64
Av. Phosphorus	%	0.44	0.42	0.40	0.38	0.36
Sodium	%	0.20	0.19	0.18	0.17	0.16
Chloride	%	0.22	0.21	0.20	0.19	0.18
Potassium	%	0.87	0.82	0.78	0.74	0.71
Linoleic Acid	%	1.33	1.26	1.20	1.14	1.09

Table-5: Consumption based Nutrient Levels for BV300: Phase - II

31 to 55 weeks age						
Nutrients	**Unit**	**Daily Feed Consumption per bird (g)**				
		100	**105**	**110**	**115**	**120**
Metabolizable Energy	Kcal/kg	2600	2600	2600	2600	2600
Crude Protein	%	16.75	16.00	15.25	14.50	14.00
Crude Fiber (min)	%	4.5	4.5	4.5	4.5	4.5
Ether Extract (min)	%	2.5	2.5	2.5	2.5	2.5
Total Lysine	%	0.82	0.78	0.74	0.71	0.68
Total Methionine	%	0.44	0.42	0.40	0.38	0.37
Total Meth + Cysteine	%	0.71	0.67	0.64	0.62	0.59
Total Threonine	%	0.61	0.58	0.55	0.53	0.50
Total Tryptophan	%	0.18	0.17	0.16	0.16	0.15
Total Arginine	%	1.04	0.99	0.94	0.90	0.86
Total Isoleucine	%	0.64	0.61	0.59	0.56	0.54
Total Valine	%	0.74	0.71	0.68	0.65	0.62
Dig. Lysine	%	0.72	0.68	0.65	0.62	0.60
Dig. Methionine	%	0.41	0.39	0.38	0.36	0.34
Dig. Meth + Cysteine	%	0.63	0.60	0.57	0.55	0.53
Dig. Threonine	%	0.50	0.48	0.46	0.44	0.42
Dig. Tryptophan	%	0.16	0.15	0.14	0.14	0.13
Dig. Arginine	%	0.79	0.75	0.72	0.69	0.66
Dig. Isoleucine	%	0.57	0.54	0.52	0.49	0.47
Dig. Valine	%	0.66	0.62	0.60	0.57	0.55
Calcium	%	4.20	4.00	3.82	3.65	3.50
Av. Phosphorus	%	0.38	0.36	0.35	0.33	0.32
Sodium	%	0.18	0.17	0.16	0.16	0.15
Chloride	%	0.20	0.19	0.18	0.17	0.17
Potassium	%	0.77	0.73	0.70	0.67	0.64
Linoleic Acid	%	1.20	1.14	1.09	1.04	1.00

Table-6: Consumption based Nutrient Levels for BV300: Phase - III

56 to 80 weeks age						
Nutrients	**Unit**	**Daily Feed Consumption per bird (g)**				
		100	**105**	**110**	**115**	**120**
Metabolizable Energy	Kcal/kg	2550	2550	2550	2550	2550
Crude Protein	%	16.50	15.75	15.00	14.50	13.75
Crude Fiber (min)	%	4.5	4.5	4.5	4.5	4.5
Ether Extract (min)	%	2.0	2.0	2.0	2.0	2.0
Total Lysine	%	0.78	0.75	0.71	0.68	0.65
Total Methionine	%	0.40	0.38	0.37	0.35	0.34
Total Meth + Cysteine	%	0.66	0.63	0.60	0.58	0.55
Total Threonine	%	0.58	0.55	0.53	0.50	0.48
Total Tryptophan	%	0.17	0.16	0.16	0.15	0.14
Total Arginine	%	0.99	0.94	0.90	0.86	0.82
Total Isoleucine	%	0.61	0.58	0.55	0.53	0.51
Total Valine	%	0.72	0.68	0.65	0.62	0.60
Dig. Lysine	%	0.685	0.65	0.62	0.60	0.57
Dig. Methionine	%	0.38	0.36	0.34	0.33	0.31
Dig. Meth + Cysteine	%	0.59	0.56	0.53	0.51	0.49
Dig. Threonine	%	0.48	0.45	0.43	0.42	0.40
Dig. Tryptophan	%	0.15	0.14	0.13	0.13	0.12
Dig. Arginine	%	0.75	0.72	0.69	0.66	0.63
Dig. Isoleucine	%	0.53	0.51	0.48	0.46	0.44
Dig. Valine	%	0.62	0.59	0.56	0.54	0.52
Calcium	%	4.40	4.19	4.00	3.83	3.67
Av. Phosphorus	%	0.32	0.30	0.29	0.28	0.27
Sodium	%	0.18	0.17	0.16	0.16	0.15
Chloride	%	0.20	0.19	0.18	0.17	0.17
Potassium	%	0.76	0.72	0.69	0.66	0.63
Linoleic Acid	%	1.10	1.05	1.00	0.96	0.92

Table-7: Consumption based Nutrient Levels for BV300: Phase - IV

81 weeks above age						
Nutrients	**Unit**	**Daily Feed Consumption per bird (g)**				
		100	**105**	**110**	**115**	**120**
Metabolizable Energy	Kcal/kg	2500	2500	2500	2500	2500
Crude Protein	%	16.00	15.25	14.50	14.00	13.50
Crude Fiber (min)	%	4.5	4.5	4.5	4.5	4.5
Ether Extract (min)	%	2.0	2.0	2.0	2.0	2.0
Total Lysine	%	0.75	0.72	0.68	0.65	0.63
Total Methionine	%	0.38	0.36	0.34	0.33	0.31
Total Meth + Cysteine	%	0.63	0.60	0.57	0.55	0.53
Total Threonine	%	0.56	0.53	0.50	0.48	0.46
Total Tryptophan	%	0.16	0.16	0.15	0.14	0.14
Total Arginine	%	0.94	0.90	0.86	0.82	0.79
Total Isoleucine	%	0.58	0.55	0.52	0.50	0.48
Total Valine	%	0.69	0.66	0.63	0.60	0.58
Dig. Lysine	%	0.65	0.62	0.59	0.57	0.54
Dig. Methionine	%	0.35	0.33	0.32	0.30	0.29
Dig. Meth + Cysteine	%	0.55	0.53	0.50	0.48	0.46
Dig. Threonine	%	0.45	0.43	0.41	0.40	0.38
Dig. Tryptophan	%	0.14	0.13	0.13	0.12	0.12
Dig. Arginine	%	0.72	0.68	0.65	0.62	0.60
Dig. Isoleucine	%	0.50	0.48	0.46	0.44	0.42
Dig. Valine	%	0.60	0.57	0.54	0.52	0.50
Calcium	%	4.60	4.38	4.18	4.00	3.83
Av. Phosphorus	%	0.30	0.29	0.27	0.26	0.25
Sodium	%	0.18	0.17	0.16	0.16	0.15
Chloride	%	0.20	0.19	0.18	0.17	0.17
Potassium	%	0.75	0.71	0.68	0.65	0.63
Linoleic Acid	%	1.00	0.95	0.91	0.87	0.83

Table-8: Recommended Ideal Amino Acid ratios for rearing and laying period.

	Chick	Grower	Developer	Pre-lay	Phase-I	Phase-II	Phase-III	Phase-IV
Dig. Lysine	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Dig. Methionine	**50**	**50**	**54**	**57**	**60**	**57**	**55**	**54**
Dig. M+C	**76**	**78**	**86**	**88**	**90**	**88**	**86**	**85**
Dig. Threonine	**67**	**67**	**70**	**70**	**70**	**70**	**70**	**70**
Dig. Tryptophan	**20**	**20**	**23**	**22**	**22**	**22**	**22**	**22**
Dig. Arginine	**120**	**120**	**120**	**120**	**110**	**110**	**110**	**110**
Dig. Isoleucine	**73**	**73**	**80**	**80**	**80**	**79**	**78**	**77**
Dig. Valine	**81**	**83**	**95**	**92**	**91**	**91**	**91**	**92**

Digestible Lysine as 100 and other amino acids as ratios to 100

Table 9: Recommended Vitamins and Trace minerals for Rearing and Laying feed

	Vitamins/Trace minerals	Units	per kg feed
Vitamins	Vitamin A	IU	12000
	Vitamin D3	IU	3500
	Thiamine (B1)	mg	4
	Riboflavin (B2)	mg	10
	Niacin (B3)	mg	40
	Pantothenic acid (B5)	mg	15
	Pyridoxin (B6)	mg	5
	Biotin (B7)	mcg	150
	Folic Acid (B9)	mg	1
	Cyanocobalamin (B12)	mcg	25
	Ascorbic Acid (Vit.- C)	mg	50
	Vitamin E	mg	50
	Vitamin K3	mg	3
	Choline Chloride 60% added	mg	1500
Trace minerals	Copper	mg	20
	Zinc	mg	110
	Iron	mg	80
	Manganese	mg	110
	Iodine	mg	1.2
	Selenium	mg	0.4

1. Add 200 mg / kg feed additional Vitamin C in hot and stressful conditions.
2. If there is possibility of more than usual loss of vitamins in the process of feed manufacturing and/or in specific disease condition, the vitamin levels may be increased as per the suggestions of the Nutritionist or disease expert
3. Store all vitamins in an air-conditioned room.

Table 10: Performance Goal: BV300 commercial

Livability%			
	0 to 18 weeks	:	96 - 98
	19 to 80 weeks	:	93
	19 to 100 weeks	:	91
Feed Intake			
	0 to 18 weeks	:	5.6 Kg
	19 to 80 weeks	:	46.5 Kg
	19 to 100 weeks	:	61.2 Kg
Body Weight			
	At 16 weeks of age	:	1.10 kg
	At 22 weeks of age	:	1.40 kg
	At 32 weeks of age	:	1.50 kg
	At 100 weeks of age	:	1.57 kg
Sexual Maturity			
	Age at 50% rate of lay	:	20 week
	Age at 90% rate of lay	:	22 week
Egg Production			
	Peak Production	:	98%
	Egg Production above 90%	:	45 weeks
	Total Hen Housed eggs for 72 weeks	:	340
	Total Hen Housed eggs for 80 weeks	:	386
	Total Hen Housed eggs for 100 weeks	:	490
Egg Weight			
	Egg Weight at 22 weeks of age	:	50g
	Egg Weight at 26 weeks of age	:	55g
Feed Conversion			
	Feed/egg for 19-80 weeks of age	:	121g
	Feed/egg for 19-100 weeks of age	:	125g
Egg Characteristics			
	Shell quality	:	for extended period
	Shell colour	:	Uniform white
	Variation in egg size (Uniformity of eggs)	:	Uniform

Table 11: BV300 commercial layers performance objectives

Age	Cum. Depletion%	% HDP	Cur HHP	Cum HHP	Feed/ Day(g)	Current Feed/ egg(g)	Cum. Feed/ egg(g)	Egg weight (g)	Body weight (g)
19	0.01	25.0	1.8	2	80	320	320	42.5	1300
20	0.02	50.0	3.5	5	85	170	220	45.0	1350
21	0.05	75.0	5.2	10	90	120	170	47.5	1380
22	0.07	90.0	6.3	17	95	106	146	50.0	1400
23	0.10	93.0	6.5	23	100	108	135	51.5	1415
24	0.12	95.0	6.6	30	105	111	130	52.8	1430
25	0.15	96.0	6.7	37	105	109	126	54.0	1440
26	0.20	96.5	6.7	43	107	111	124	55.0	1450
27	0.25	97.0	6.8	50	108	111	122	55.5	1460
28	0.30	97.5	6.8	57	110	113	121	55.8	1470
29	0.35	98.0	6.8	64	110	112	120	56.0	1480
30	0.40	98.0	6.8	71	110	112	119	56.2	1490
31	0.45	98.0	6.8	77	110	112	119	56.4	1495
32	0.50	98.0	6.8	84	110	112	118	56.5	1500
33	0.55	97.9	6.8	91	110	112	118	56.6	1505
34	0.61	97.8	6.8	98	110	112	117	56.7	1510
35	0.67	97.7	6.8	105	110	113	117	56.8	1515
36	0.73	97.6	6.8	111	110	113	117	56.9	1520
37	0.80	97.5	6.8	118	110	113	117	57.0	1523
38	0.87	97.3	6.8	125	110	113	116	57.1	1525
39	0.94	97.1	6.7	132	111	114	116	57.2	1527
40	1.01	96.9	6.7	138	111	115	116	57.3	1529
41	1.09	96.7	6.7	145	111	115	116	57.4	1531
42	1.17	96.5	6.7	152	111	115	116	57.5	1532
43	1.26	96.3	6.7	158	111	115	116	57.6	1533
44	1.35	96.1	6.6	165	112	117	116	57.7	1534
45	1.44	95.9	6.6	172	112	117	116	57.8	1535
46	1.53	95.7	6.6	178	112	117	116	57.9	1536
47	1.63	95.4	6.6	185	112	117	116	58.0	1537
48	1.73	95.2	6.6	191	112	118	116	58.0	1538
49	1.83	95.0	6.5	198	112	118	116	58.1	1539
50	1.93	94.7	6.5	204	112	118	116	58.2	1540
51	2.04	94.5	6.5	211	112	119	116	58.2	1541
52	2.15	94.2	6.5	217	112	119	116	58.3	1542
53	2.27	94.0	6.4	224	112	119	117	58.4	1543
54	2.39	93.7	6.4	230	112	120	117	58.4	1544
55	2.51	93.4	6.4	237	112	120	117	58.5	1545
56	2.63	93.1	6.3	243	112	120	117	58.5	1546
57	2.75	92.8	6.3	249	112	121	117	58.6	1547
58	2.87	92.5	6.3	256	112	121	117	58.6	1548
59	2.99	92.2	6.3	262	112	121	117	58.7	1549
60	3.11	91.9	6.2	268	113	123	117	58.7	1550

Table 11: BV300 commercial layers performance objectives

Age	Cum. Depletion%	% HDP	Cur HHP	Cum HHP	Feed/ Day(g)	Current Feed/ egg(g)	Cum. Feed/ egg(g)	Egg weight (g)	Body weight (g)
61	3.24	91.6	6.2	274	113	123	117	58.8	1551
62	3.37	91.3	6.2	280	113	124	118	58.8	1551
63	3.50	91.0	6.1	287	113	124	118	58.9	1552
64	3.64	90.7	6.1	293	113	125	118	58.9	1552
65	3.78	90.3	6.1	299	113	125	118	59.0	1553
66	3.92	90.0	6.1	305	114	127	118	59.0	1553
67	4.06	89.7	6.0	311	114	127	118	59.1	1554
68	4.20	89.3	6.0	317	114	128	118	59.1	1554
69	4.35	89.0	6.0	323	114	128	119	59.2	1555
70	4.50	88.6	5.9	329	114	129	119	59.2	1555
71	4.65	88.3	5.9	335	114	129	119	59.3	1556
72	4.80	87.9	5.9	340	114	130	119	59.3	1556
73	4.95	87.6	5.8	346	114	130	119	59.4	1557
74	5.10	87.2	5.8	352	114	131	120	59.4	1557
75	5.25	86.8	5.8	358	114	131	120	59.5	1558
76	5.40	86.4	5.7	364	114	132	120	59.5	1558
77	5.55	86.1	5.7	369	114	132	120	59.6	1559
78	5.70	85.7	5.7	375	114	133	120	59.6	1559
79	5.85	85.3	5.6	381	114	134	121	59.6	1560
80	6.00	84.9	5.6	386	114	134	121	59.7	1560
81	6.15	84.5	5.6	392	114	135	121	59.7	1561
82	6.30	84.1	5.5	397	114	136	121	59.8	1561
83	6.45	83.7	5.5	403	114	136	121	59.8	1562
84	6.60	83.3	5.4	408	114	137	122	59.9	1562
85	6.75	82.9	5.4	414	114	138	122	59.9	1563
86	6.90	82.5	5.4	419	114	138	122	60.0	1563
87	7.05	82.0	5.3	424	114	139	122	60.0	1564
88	7.20	81.6	5.3	430	114	140	122	60.1	1564
89	7.35	81.1	5.3	435	114	141	123	60.1	1565
90	7.50	80.6	5.2	440	114	141	123	60.2	1565
91	7.65	80.2	5.2	445	114	142	123	60.2	1566
92	7.80	79.7	5.1	450	114	143	123	60.3	1566
93	7.95	79.2	5.1	456	114	144	124	60.3	1567
94	8.10	78.6	5.1	461	114	145	124	60.4	1567
95	8.25	78.1	5.0	466	114	146	124	60.4	1568
96	8.40	77.6	5.0	471	114	147	124	60.5	1568
97	8.55	77.0	4.9	475	114	148	124	60.5	1569
98	8.70	76.5	4.9	480	114	149	125	60.6	1569
99	8.85	75.9	4.8	485	114	150	125	60.6	1570
100	9.00	75.3	4.8	490	114	151	125	60.7	1570

Note: These performances are based on actual flock results obtained under good nutrition, environmental and managemental conditions. However, these specifications do not express or imply a warranty of performance, as it may vary because of variety of reasons.

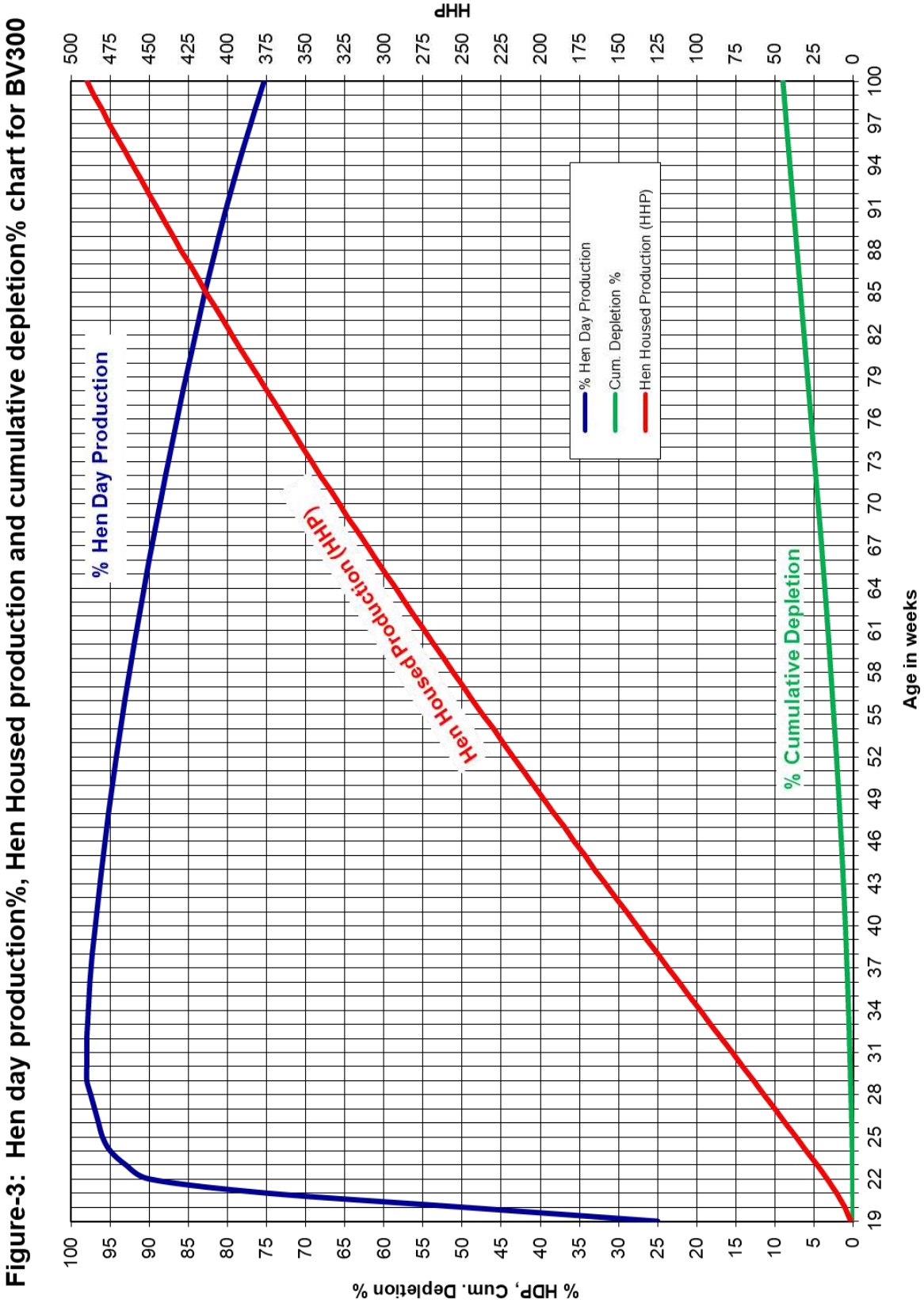


Figure-3: Hen day production%, Hen Housed production and cumulative depletion% chart for BV300

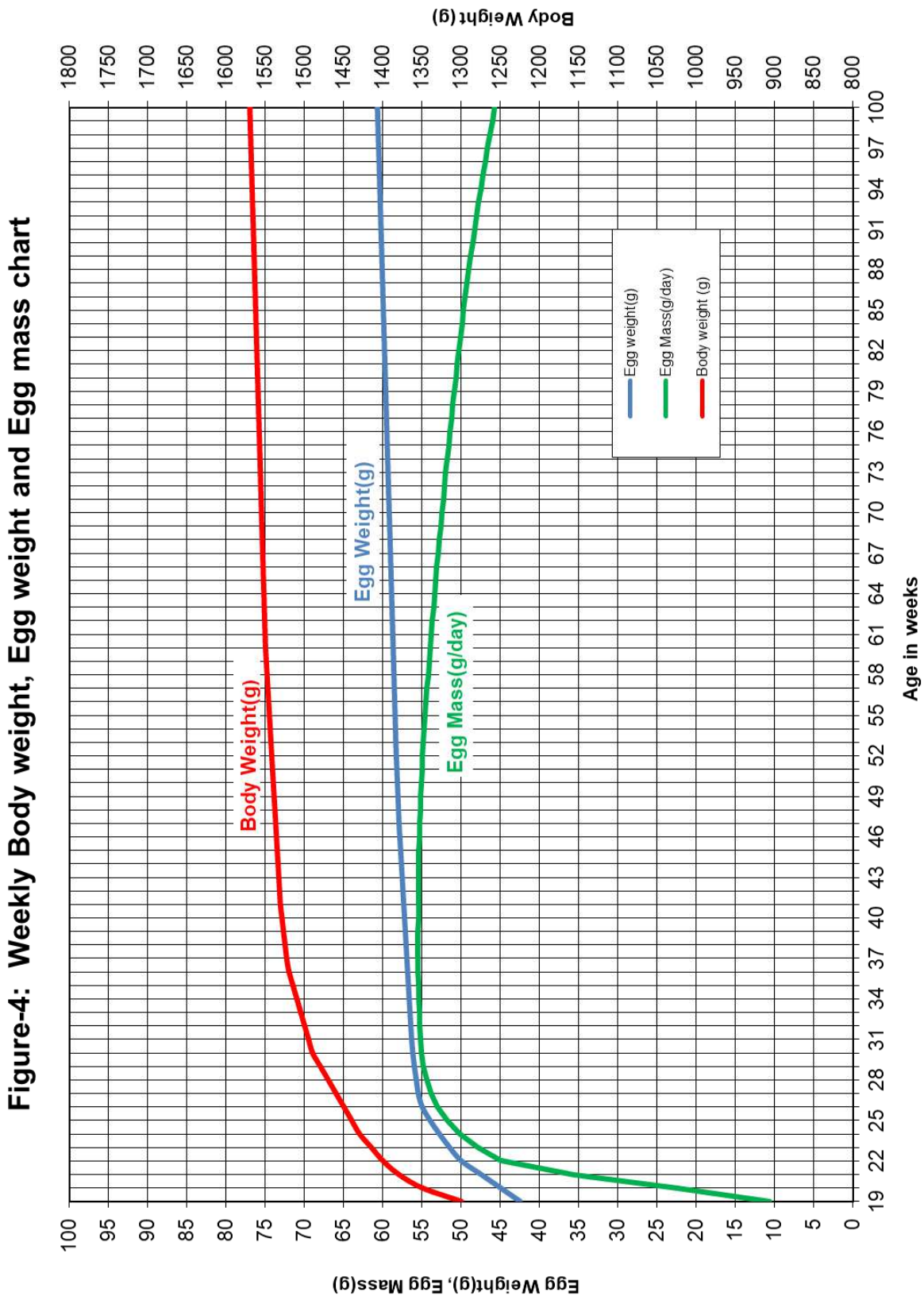
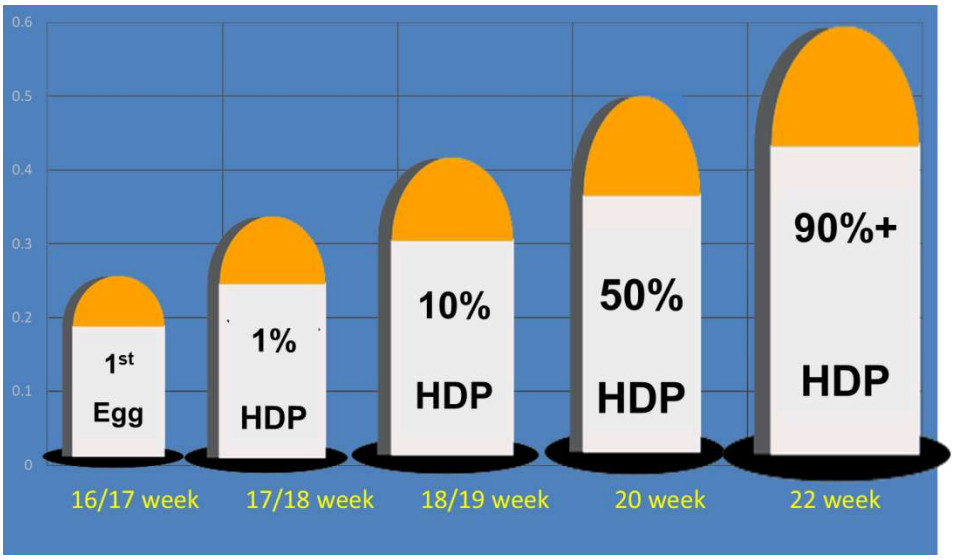


Figure-4: Weekly Body weight, Egg weight and Egg mass chart
Body Weight (g)
Egg Weight(g), Egg Mass(g)
Age in weeks
Egg weight(g)
Egg Mass(g/day)
Body weight (g)
Egg Weight(g)
Egg Mass(g/day)
Body Weight(g)

Figure – 5: Production milestones



☞ ***Economic indicators in commercial layers***

↓ 1 gram Feed per egg	≡	↑ 9 Rs profit per bird
↑ 1% average Hen Day Production	≡	↑ 4.2 Eggs per Hen Housed
	≡	↑ 17 Rs. profit per bird
↓ 1 % laying mortality	≡	↑ 7 Rs profit per bird
↓ 1000 Rs per ton feed cost		Economical if HDP% is not reduced more than 2.6% (equivalent to 11 eggs HHP)

Table 12: Nutrient composition of feed ingredients

Ingredient (as-fed basis, Dry matter 88-90% and Moisture 10-12%)	Metabolizable Energy (Kcal /kg)	Crude Protein %	Crude Fiber %	Ether Extract %	Calcium %	Available Phosphorus %	Sodium %	Chloride%	Potassium %	Linoleic Acid %	Choline g/kg
Maize	3350	8.00	2.00	3.30	0.01	0.13	0.05	0.05	0.34	1.78	0.500
Jowar	3260	9.00	2.40	3.00	0.03	0.05	0.01	0.07	0.35	1.38	0.400
Bajra	3300	10.00	2.20	4.00	0.01	0.10	0.04	0.05	0.30	1.50	0.230
Rice grade- I	3450	8.00	0.50	1.00	0.01	0.10	0.01	0.03	0.09	0.40	0.600
Rice grade- II	3050	7.80	1.00	0.70	0.01	0.09	0.01	0.03	0.07	0.30	0.183
Wheat	3100	11.00	2.50	1.55	0.04	0.20	0.01	0.06	0.38	0.95	0.700
Rice polish	2950	12.50	7.50	16.00	0.40	0.15	0.04	0.04	0.99	4.39	1.000
Deoiled Rice bran	1750	16.00	12.50	0.70	0.07	0.18	0.04	0.06	1.20	0.20	0.670
Wheat bran	2050	15.00	8.50	3.50	0.14	0.40	0.02	0.13	1.23	1.62	1.100
Soybean crude oil	9950			99.50						51.04	
Rice bran crude oil	9750			99.50						34.97	
Deoiled Soybean meal (46%)	2275	46.00	5.50	1.00	0.31	0.25	0.02	0.04	2.22	0.59	2.65
Deoild Groundnut meal (40%)	2200	40.00	10.00	1.20	0.22	0.20	0.02	0.04	0.98	0.21	1.50
Deoiled Sunflower meal (28%)	1435	28.00	22.50	1.25	0.35	0.35	0.02	0.11	1.48	1.39	2.50
Deoiled Rapeseed meal (36%)	1620	36.00	10.50	1.50	0.78	0.34	0.04	0.04	1.28	0.51	1.65
DDGS Rice (45%)	2500	45.00	2.00	4.00	0.20	0.10	0.02	0.05	1.50	0.40	2.00
Cottonseed meal (35%)	1500	35.00	14.00	1.50	0.20	0.48	0.07	0.04	1.52	1.20	1.10
Sesame meal (30%)	1700	30.00	10.00	2.00	2.30	0.50	0.02	0.04	1.04	0.50	1.00
Fish meal (45%)	2850	45.00	0.30	7.50	4.02	2.60	1.05	1.52	0.82	0.10	3.00
Meat and bone meal (45%)	2150	45.00	2.00	9.00	10.00	5.00	0.60	0.70	1.25	0.16	1.10
Marble grit					37.5						
Limestone powder					37.0						
Di calcium phosphate					23.0	17.0					
Mono calcium phosphate					17.0	21.0					
L- Lysine	3728	94.5						19.0			
DL- Methionine	3652	58.0									
L-Threonine	3375	72.5									
L-Tryptophan	4027	84.0									
Salt							38.9	60.1			
Sodium bi-carbonate							26.8				
Potassium chloride (95.3%)							47.0	52.4			
Choline Chloride (60%)								15.23			450

Source: Schothorst Feed Research data, July 2022

- Nutrient values should be confirmed by analysis of the materials being used in order to maintain an accurate nutrient matrix.
- Maintain Moisture content below 12 % for long storage of grains. Grains should be free from insecticides, fungus (green/black), weevils, fowl / musty smell, sand / soil, and damaged seeds.
- Urease activity of Soybean DOC should be less than 0.3 mg nitrogen /Min @30^{o}C.

Table 13: Digestible Amino acid composition of feed ingredients

Ingredient (as-fed basis, Dry matter 88-90% and Moisture 10-12%)	Lysine %	Methionine %	Cysteine %	Methionine + Cysteine %	Threonine %	Tryptophan %	Arginine %	Isoleucine%	Valine %
Maize	0.20	0.14	0.14	0.29	0.24	0.04	0.33	0.24	0.32
Jowar	0.18	0.13	0.14	0.27	0.24	0.09	0.30	0.32	0.39
Bajra	0.28	0.19	0.14	0.33	0.29	0.14	0.40	0.33	0.43
Rice - Grade I	0.24	0.18	0.14	0.32	0.23	0.09	0.56	0.27	0.38
Rice - Grade II	0.20	0.15	0.12	0.26	0.19	0.07	0.46	0.22	0.31
Wheat	0.27	0.16	0.22	0.38	0.28	0.12	0.47	0.36	0.43
Rice Polish	0.47	0.20	0.17	0.36	0.32	0.12	0.81	0.32	0.50
Deoiled Rice bran	0.56	0.24	0.20	0.44	0.42	0.16	0.95	0.42	0.65
Wheat bran	0.46	0.17	0.22	0.40	0.35	0.18	0.81	0.37	0.52
Deoiled Soybean meal (46%)	2.49	0.58	0.49	1.06	1.45	0.52	3.00	1.80	1.85
Deoiled Groundnut meal (40%)	1.10	0.39	0.45	0.82	0.96	0.38	4.50	1.25	1.50
Deoiled Sunflower meal (28%)	0.74	0.53	0.31	0.84	0.73	0.29	1.94	0.89	1.05
Deoiled rapeseed meal (36%)	1.42	0.57	0.58	1.15	1.04	0.35	1.72	1.04	1.32
DDGS Rice (45%)	0.98	0.97	0.66	1.63	1.21	0.45	2.42	1.62	1.73
Cottonseed meal (35%)	0.87	0.39	0.42	0.81	0.81	0.31	3.17	0.81	1.15
Sesame meal (30%)	0.65	0.80	0.50	1.30	0.88	0.42	3.22	0.92	1.16
Fish meal (45%)	2.94	1.08	0.28	1.37	1.64	0.38	2.50	1.80	2.05
Meat and bone meal (45%)	1.40	0.36	0.08	0.45	0.76	0.11	2.38	0.71	1.15
L- Lysine	78.95								
DL Methionine		98.98		98.98					
L-Threonine					97.99				
L-Tryptophan						97.99			

Source: Schothorst Feed Research data, July 2022

Table14: Ready Reckoner to estimate feed consumption of the flock.

ME Requirement (Kcal/b/day) = ME for Production+ ME for Maintenance + ME for Body Wt. gain

A. **Production**: Find out ME requirements for production based on HDP% and Egg wt.

	Hen Day Production (HDP)%										
Egg Wt(g)	78	80	82	84	86	88	90	92	94	96	98
54.0	84	86	89	91	93	95	97	99	102	104	106
54.5	85	87	89	92	94	96	98	100	102	105	107
55.0	86	88	90	92	95	97	99	101	103	106	108
55.5	87	89	91	93	95	98	100	102	104	107	109
56.0	87	90	92	94	96	99	101	103	105	108	110
56.5	88	90	93	95	97	99	102	104	106	108	111
57.0	89	91	93	96	98	100	103	105	107	109	112
57.5	90	92	94	97	99	101	104	106	108	110	113
58.0	90	93	95	97	100	102	104	107	109	111	114
58.5	91	94	96	98	101	103	105	108	110	112	115
59.0	92	94	97	99	101	104	106	109	111	113	116

B. **Maintenance:** Find out ME requirements for the given body weight and average temperature of the day from below given table.

	Average Temp ^{0}C										
Body Wt (k	28	27	26	25	24	23	22	21	20	19	18
1.25	136	138	141	144	147	149	152	155	158	160	163
1.30	141	144	147	150	152	155	158	161	164	167	170
1.35	146	149	152	155	158	161	164	167	170	173	176
1.40	152	155	158	161	164	167	170	173	176	179	183
1.45	157	160	164	167	170	173	176	180	183	186	189
1.50	163	166	169	173	176	179	182	186	189	192	196
1.55	168	171	175	178	182	185	188	192	195	199	202
1.60	173	177	180	184	188	191	195	198	202	205	209
1.65	179	182	186	190	193	197	201	204	208	212	215
1.70	184	188	192	196	199	203	207	210	214	218	222

C. **Growth:** Find out ME requirements body weight gain per day

	Body Weight gain(g/day)										
	0.3	0.5	0.7	0.9	1	1.5	2	2.5	4	6	7
ME(Kcal)	1.5	2.5	3.5	4.5	5	7.5	10	12.5	20	30	35

D. Total ME requirement: for example from above highlighted figures {105+173+2.5 = 280.5 Kcal/b/day}

E. **Feed consumption Estimation:** Feed consumption can be estimated from below table for the ME requirement and ME content in the feed. (eg. if ME requirement is 280 and ME content in the feed is 2550 Kcal then estimated feed consumption of the flock will be around 110g).

Diet Calorie	ME Requirement of Birds (Kcal/b/d)										
kcal / kg	250	260	265	270	275	280	285	290	290	300	310
2300	109	113	115	117	120	122	124	126	126	130	135
2350	106	111	113	115	117	119	121	123	123	128	132
2400	104	108	110	113	115	117	119	121	121	125	129
2450	102	106	108	110	112	114	116	118	118	122	127
2500	100	104	106	108	110	112	114	116	116	120	124
2550	98	102	104	106	108	110	112	114	114	118	122
2600	96	100	102	104	106	108	110	112	112	115	119
2650	94	98	100	102	104	106	108	109	109	113	117
2700	93	96	98	100	102	104	106	107	107	111	115

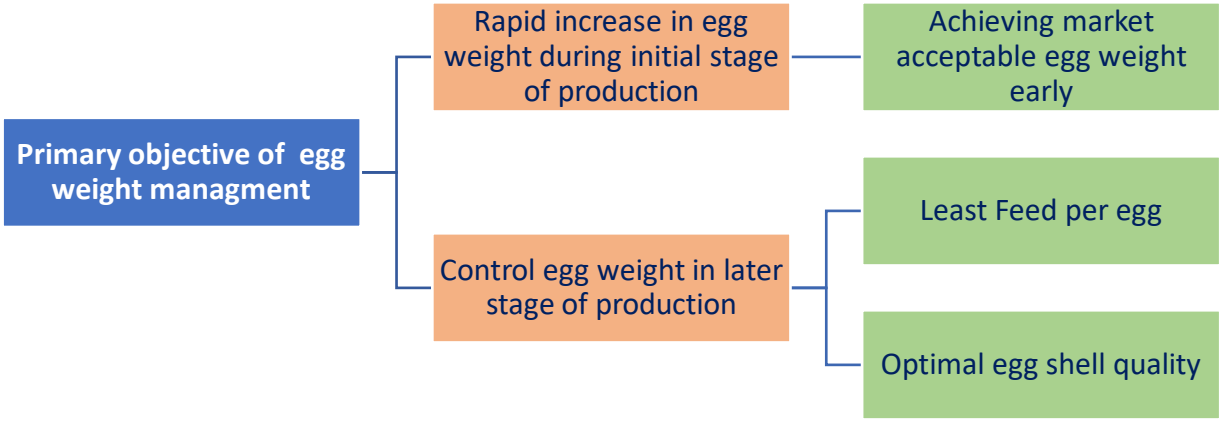
Above calculations are based on the formula:

ME Requirement = BWT kg (170 – 2.2 x Avg Temp ^{o}C) + (BWT gain(g/day) x 5) + (2 x (HDP% x EWT)/100)

Table 15 : Ready Reckoner for Feed Cost per Egg

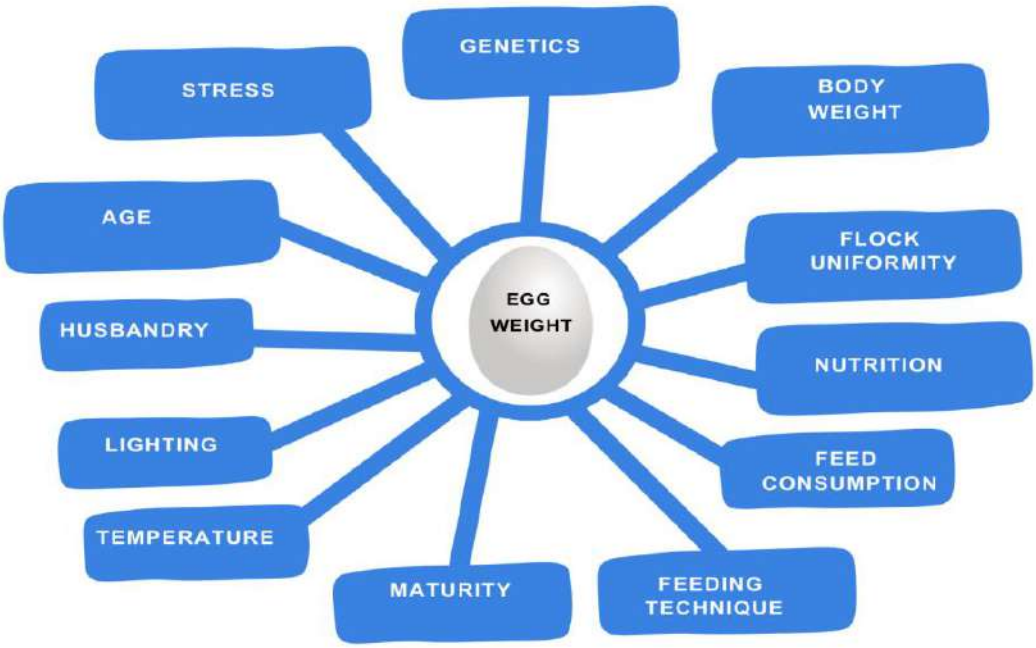
HDP %	Fd / d/b (g)	Feed Rate (Rs/kg)																
		22	22.5	23	23.5	24	24.5	25	25.5	26	26.5	27	27.5	28	28.5	29	29.5	30
75	90	2.64	2.70	2.76	2.82	2.88	2.94	3.00	3.06	3.12	3.18	3.24	3.30	3.36	3.42	3.48	3.54	3.60
	95	2.79	2.85	2.91	2.98	3.04	3.10	3.17	3.23	3.29	3.36	3.42	3.48	3.55	3.61	3.67	3.74	3.80
	100	2.93	3.00	3.07	3.13	3.20	3.27	3.33	3.40	3.47	3.53	3.60	3.67	3.73	3.80	3.87	3.93	4.00
	105	3.08	3.15	3.22	3.29	3.36	3.43	3.50	3.57	3.64	3.71	3.78	3.85	3.92	3.99	4.06	4.13	4.20
	110	3.23	3.30	3.37	3.45	3.52	3.59	3.67	3.74	3.81	3.89	3.96	4.03	4.11	4.18	4.25	4.33	4.40
	115	3.37	3.45	3.53	3.60	3.68	3.76	3.83	3.91	3.99	4.06	4.14	4.22	4.29	4.37	4.45	4.52	4.60
	120	3.52	3.60	3.68	3.76	3.84	3.92	4.00	4.08	4.16	4.24	4.32	4.40	4.48	4.56	4.64	4.72	4.80
80	90	2.48	2.53	2.59	2.64	2.70	2.76	2.81	2.87	2.93	2.98	3.04	3.09	3.15	3.21	3.26	3.32	3.38
	95	2.61	2.67	2.73	2.79	2.85	2.91	2.97	3.03	3.09	3.15	3.21	3.27	3.33	3.38	3.44	3.50	3.56
	100	2.75	2.81	2.88	2.94	3.00	3.06	3.13	3.19	3.25	3.31	3.38	3.44	3.50	3.56	3.63	3.69	3.75
	105	2.89	2.95	3.02	3.08	3.15	3.22	3.28	3.35	3.41	3.48	3.54	3.61	3.68	3.74	3.81	3.87	3.94
	110	3.03	3.09	3.16	3.23	3.30	3.37	3.44	3.51	3.58	3.64	3.71	3.78	3.85	3.92	3.99	4.06	4.13
	115	3.16	3.23	3.31	3.38	3.45	3.52	3.59	3.67	3.74	3.81	3.88	3.95	4.03	4.10	4.17	4.24	4.31
	120	3.30	3.38	3.45	3.53	3.60	3.68	3.75	3.83	3.90	3.98	4.05	4.13	4.20	4.28	4.35	4.43	4.50
82.5	90	2.40	2.45	2.51	2.56	2.62	2.67	2.73	2.78	2.84	2.89	2.95	3.00	3.05	3.11	3.16	3.22	3.27
	95	2.53	2.59	2.65	2.71	2.76	2.82	2.88	2.94	2.99	3.05	3.11	3.17	3.22	3.28	3.34	3.40	3.45
	100	2.67	2.73	2.79	2.85	2.91	2.97	3.03	3.09	3.15	3.21	3.27	3.33	3.39	3.45	3.52	3.58	3.64
	105	2.80	2.86	2.93	2.99	3.05	3.12	3.18	3.25	3.31	3.37	3.44	3.50	3.56	3.63	3.69	3.75	3.82
	110	2.93	3.00	3.07	3.13	3.20	3.27	3.33	3.40	3.47	3.53	3.60	3.67	3.73	3.80	3.87	3.93	4.00
	115	3.07	3.14	3.21	3.28	3.35	3.42	3.48	3.55	3.62	3.69	3.76	3.83	3.90	3.97	4.04	4.11	4.18
	120	3.20	3.27	3.35	3.42	3.49	3.56	3.64	3.71	3.78	3.85	3.93	4.00	4.07	4.15	4.22	4.29	4.36
85	90	2.33	2.38	2.44	2.49	2.54	2.59	2.65	2.70	2.75	2.81	2.86	2.91	2.96	3.02	3.07	3.12	3.18
	95	2.46	2.51	2.57	2.63	2.68	2.74	2.79	2.85	2.91	2.96	3.02	3.07	3.13	3.19	3.24	3.30	3.35
	100	2.59	2.65	2.71	2.76	2.82	2.88	2.94	3.00	3.06	3.12	3.18	3.24	3.29	3.35	3.41	3.47	3.53
	105	2.72	2.78	2.84	2.90	2.96	3.03	3.09	3.15	3.21	3.27	3.34	3.40	3.46	3.52	3.58	3.64	3.71
	110	2.85	2.91	2.98	3.04	3.11	3.17	3.24	3.30	3.36	3.43	3.49	3.56	3.62	3.69	3.75	3.82	3.88
	115	2.98	3.04	3.11	3.18	3.25	3.31	3.38	3.45	3.52	3.59	3.65	3.72	3.79	3.86	3.92	3.99	4.06
	120	3.11	3.18	3.25	3.32	3.39	3.46	3.53	3.60	3.67	3.74	3.81	3.88	3.95	4.02	4.09	4.16	4.24
87.5	90	2.26	2.31	2.37	2.42	2.47	2.52	2.57	2.62	2.67	2.73	2.78	2.83	2.88	2.93	2.98	3.03	3.09
	95	2.39	2.44	2.50	2.55	2.61	2.66	2.71	2.77	2.82	2.88	2.93	2.99	3.04	3.09	3.15	3.20	3.26
	100	2.51	2.57	2.63	2.69	2.74	2.80	2.86	2.91	2.97	3.03	3.09	3.14	3.20	3.26	3.31	3.37	3.43
	105	2.64	2.70	2.76	2.82	2.88	2.94	3.00	3.06	3.12	3.18	3.24	3.30	3.36	3.42	3.48	3.54	3.60
	110	2.77	2.83	2.89	2.95	3.02	3.08	3.14	3.21	3.27	3.33	3.39	3.46	3.52	3.58	3.65	3.71	3.77
	115	2.89	2.96	3.02	3.09	3.15	3.22	3.29	3.35	3.42	3.48	3.55	3.61	3.68	3.75	3.81	3.88	3.94
	120	3.02	3.09	3.15	3.22	3.29	3.36	3.43	3.50	3.57	3.63	3.70	3.77	3.84	3.91	3.98	4.05	4.11
90	90	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00
	95	2.32	2.38	2.43	2.48	2.53	2.59	2.64	2.69	2.74	2.80	2.85	2.90	2.96	3.01	3.06	3.11	3.17
	100	2.44	2.50	2.56	2.61	2.67	2.72	2.78	2.83	2.89	2.94	3.00	3.06	3.11	3.17	3.22	3.28	3.33
	105	2.57	2.63	2.68	2.74	2.80	2.86	2.92	2.98	3.03	3.09	3.15	3.21	3.27	3.33	3.38	3.44	3.50
	110	2.69	2.75	2.81	2.87	2.93	2.99	3.06	3.12	3.18	3.24	3.30	3.36	3.42	3.48	3.54	3.61	3.67
	115	2.81	2.88	2.94	3.00	3.07	3.13	3.19	3.26	3.32	3.39	3.45	3.51	3.58	3.64	3.71	3.77	3.83
	120	2.93	3.00	3.07	3.13	3.20	3.27	3.33	3.40	3.47	3.53	3.60	3.67	3.73	3.80	3.87	3.93	4.00
92.5	90	2.14	2.19	2.24	2.29	2.34	2.38	2.43	2.48	2.53	2.58	2.63	2.68	2.72	2.77	2.82	2.87	2.92
	95	2.26	2.31	2.36	2.41	2.46	2.52	2.57	2.62	2.67	2.72	2.77	2.82	2.88	2.93	2.98	3.03	3.08
	100	2.38	2.43	2.49	2.54	2.59	2.65	2.70	2.76	2.81	2.86	2.92	2.97	3.03	3.08	3.14	3.19	3.24
	105	2.50	2.55	2.61	2.67	2.72	2.78	2.84	2.89	2.95	3.01	3.06	3.12	3.18	3.24	3.29	3.35	3.41
	110	2.62	2.68	2.74	2.79	2.85	2.91	2.97	3.03	3.09	3.15	3.21	3.27	3.33	3.39	3.45	3.51	3.57
	115	2.74	2.80	2.86	2.92	2.98	3.05	3.11	3.17	3.23	3.29	3.36	3.42	3.48	3.54	3.61	3.67	3.73
	120	2.85	2.92	2.98	3.05	3.11	3.18	3.24	3.31	3.37	3.44	3.50	3.57	3.63	3.70	3.76	3.83	3.89
95	90	2.08	2.13	2.18	2.23	2.27	2.32	2.37	2.42	2.46	2.51	2.56	2.61	2.65	2.70	2.75	2.79	2.84
	95	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00
	100	2.32	2.37	2.42	2.47	2.53	2.58	2.63	2.68	2.74	2.79	2.84	2.89	2.95	3.00	3.05	3.11	3.16
	105	2.43	2.49	2.54	2.60	2.65	2.71	2.76	2.82	2.87	2.93	2.98	3.04	3.09	3.15	3.21	3.26	3.32
	110	2.55	2.61	2.66	2.72	2.78	2.84	2.89	2.95	3.01	3.07	3.13	3.18	3.24	3.30	3.36	3.42	3.47
	115	2.66	2.72	2.78	2.84	2.91	2.97	3.03	3.09	3.15	3.21	3.27	3.33	3.39	3.45	3.51	3.57	3.63
	120	2.78	2.84	2.91	2.97	3.03	3.09	3.16	3.22	3.28	3.35	3.41	3.47	3.54	3.60	3.66	3.73	3.79
97.5	90	2.03	2.08	2.12	2.17	2.22	2.26	2.31	2.35	2.40	2.45	2.49	2.54	2.58	2.63	2.68	2.72	2.77
	95	2.14	2.19	2.24	2.29	2.34	2.39	2.44	2.48	2.53	2.58	2.63	2.68	2.73	2.78	2.83	2.87	2.92
	100	2.26	2.31	2.36	2.41	2.46	2.51	2.56	2.62	2.67	2.72	2.77	2.82	2.87	2.92	2.97	3.03	3.08
	105	2.37	2.42	2.48	2.53	2.58	2.64	2.69	2.75	2.80	2.85	2.91	2.96	3.02	3.07	3.12	3.18	3.23
	110	2.48	2.54	2.59	2.65	2.71	2.76	2.82	2.88	2.93	2.99	3.05	3.10	3.16	3.22	3.27	3.33	3.38
	115	2.59	2.65	2.71	2.77	2.83	2.89	2.95	3.01	3.07	3.13	3.18	3.24	3.30	3.36	3.42	3.48	3.54
	120	2.71	2.77	2.83	2.89	2.95	3.02	3.08	3.14	3.20	3.26	3.32	3.38	3.45	3.51	3.57	3.63	3.69

5. Early and late Egg weight Management



- The size of an egg is primarily determined by the size of the yolk, which, in turn, is influenced by body weight, frame, and uniformity.
- Attaining the target body weight at the point of lay and achieving incremental body weight up to maturity at 30 weeks are crucial for early egg weight attainment.

Figure: Factors affecting egg weight

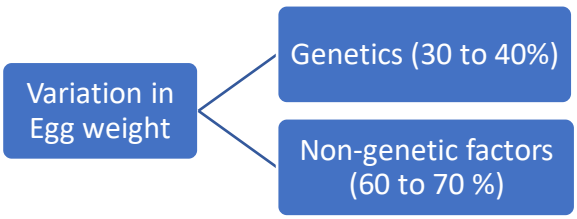


5.1 Genetics

In the BV300 breeding program, individual egg weights are measured at various stages of the life cycle.

Intense selection pressure is applied to:

- ✓ Increase egg weight during early lay.
- ✓ Maintain or minimum egg weight increase in later stage.
- ✓ Achieve a flat egg weight curve.



5.2 Body Weight

- Body weight growth target (given in table 1 and 11) for each week needs to be achieved from first week to 30 weeks of age.
- At the same time the flock uniformity should be more than 85%

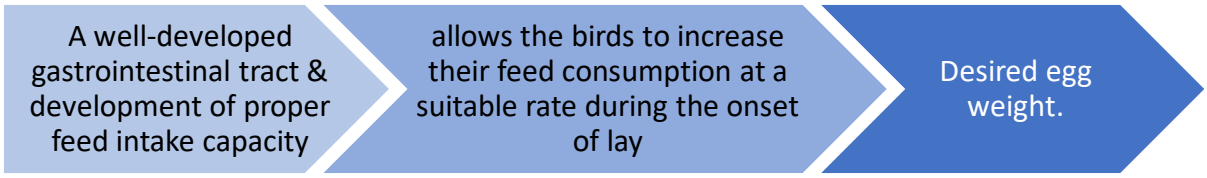
5.3 Nutrition

- ❖ Formulate rations for different periods based on the recommendations provided in the guide, taking into consideration the flock's feed intake.
- ❖ During the rearing period, transition to grower and developer feeds based on body weight changes only.
- ❖ Fourteen days before the onset of production, provide pre-lay feed, and
- ❖ starting from 0.5% production, switch to phase-1 layer mash.
- ❖ During the laying period, follow consumption-based formulations.
- ❖ Several nutritional factors significantly influence egg weight:
    - Methionine/cysteine
    - Lysine,
    - Other essential amino acids,
    - Total fat
    - Linoleic acid.
- ❖ The addition of 0.5% to 1% oil improves feed palatability and increases feed consumption, stimulating growth toward mature body weight and positively impacting egg weight.

5.4 Egg Weight and Energy

- ❖ Suboptimal energy levels in diets result in minimal increase in egg size, even with higher protein levels, as the hen utilizes protein to meet energy requirements.
- ❖ One of the primary limiting factors for early egg size is suboptimal energy intake in many flocks that begin production at a young age and quickly reach peak production, with feed consumption increments falling below target levels.

5.5 Feed Consumption



To develop the digestive system and capacity for a rapid increase in feed consumption at the point of lay:

- ☞ Empty the feeders once a day starting from five weeks of age onwards.
- ☞ Increase level of insoluble fiber during the developer phase.

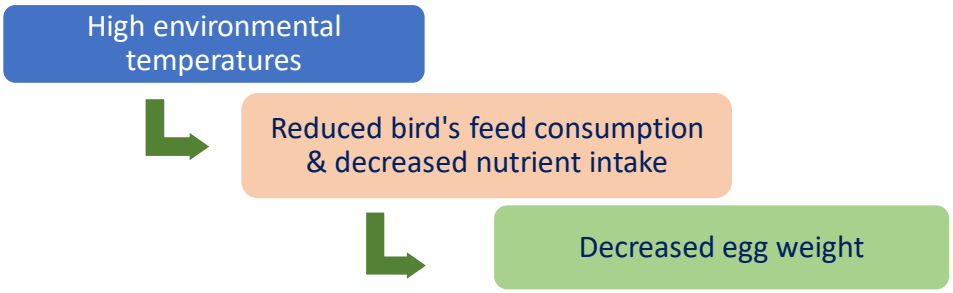
5.6 Sexual Maturity

To meet the early egg weight goal, it is important to attain the target body weight at the onset of production. Light stimulation should be provided only when the target body weight is reached.

5.7 Lighting and Mid-Night Snack

Follow the recommended lighting and mid-night snack protocol provided in chapter 10 (pages 46 to 49).

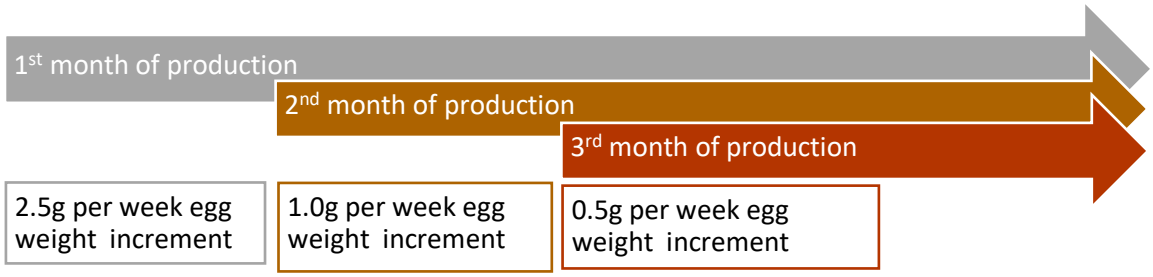
5.8 Temperature



Follow consumption-based formulations and implement summer management practices outlined in chapter 7 (pages 41-43) to mitigate the effects of summer stress.

5.9 Age

- In the first month of production egg weight increase rapidly.



5.10 Optimum Egg Weight

- For additional 1.6 gram egg weight, 1 gram additional feed is required.
- Once the average egg weight meets the market requirement, further increasing egg weight does not yield additional revenue. Start controlling egg weight before target is achieved.
- The shell weight remains constant as the egg weight increases, resulting in thinner eggshells. So controlling egg weight improves the shell quality.
- Follow the phase feeding recommendations provided in the diet specifications guide to maintain optimum egg weight (Table 3, page 18).

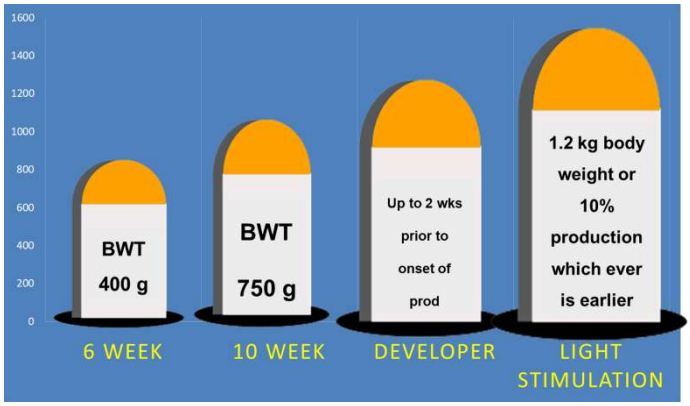


Figure- 6: Body weight milestones

Figure-7: Increment in feed consumption(gram/bird/day) during early lay period

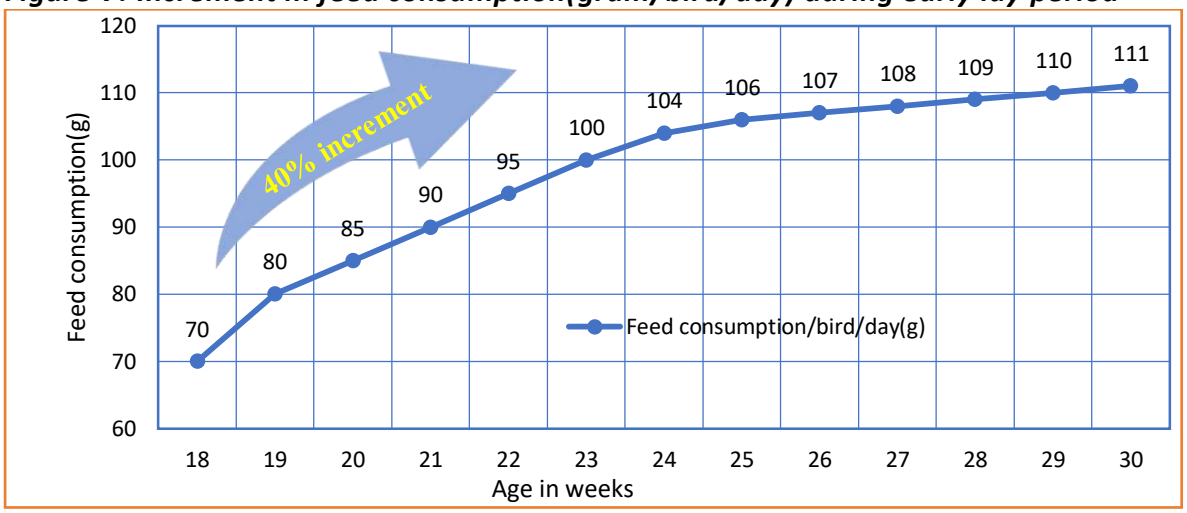


Figure-8: Increment in Body weight during early lay period

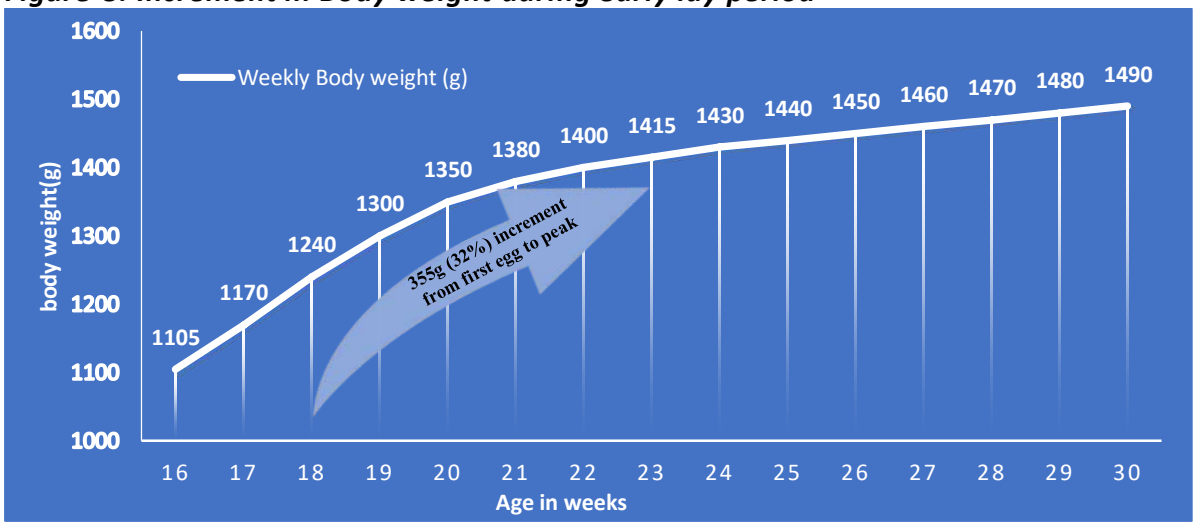
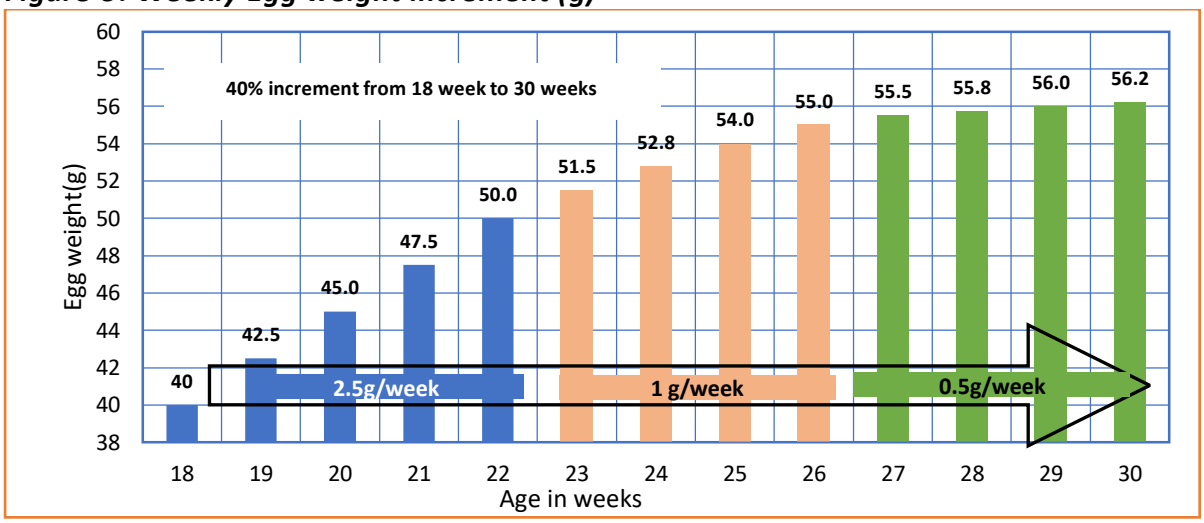


Figure-9: Weekly Egg weight increment (g)



6. *Optimal Eggshell Quality*

Eggshells are remarkable structures, and maintaining acceptable shell quality throughout the laying cycle requires a thorough understanding of the factors that influence it.

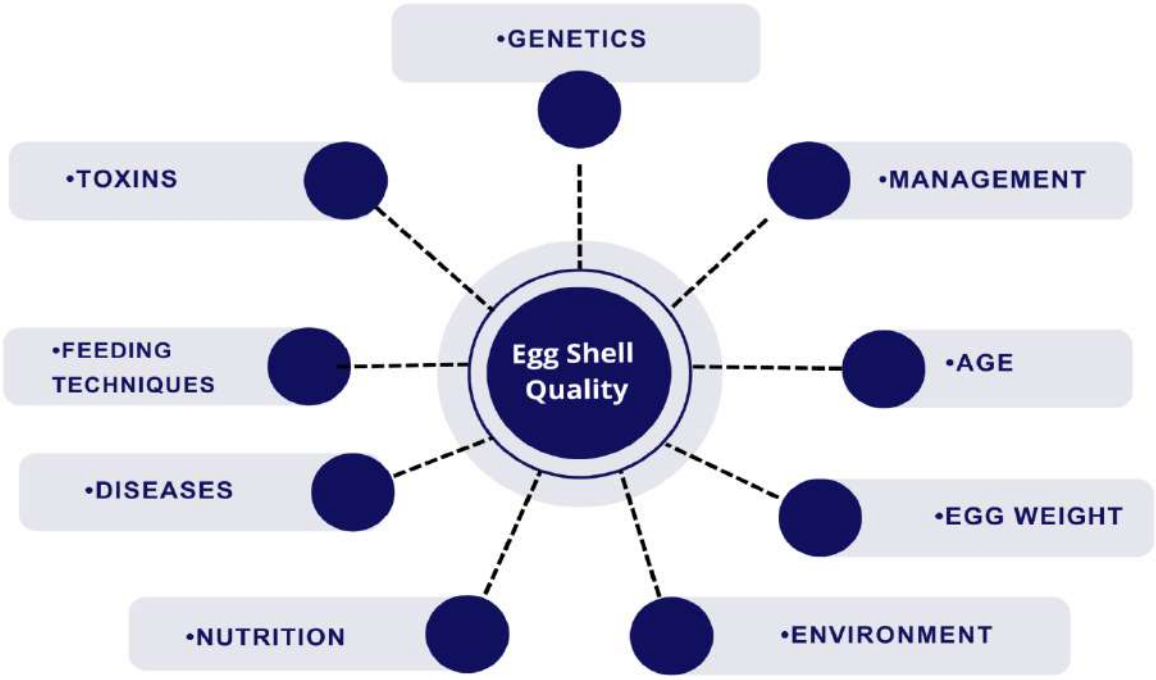
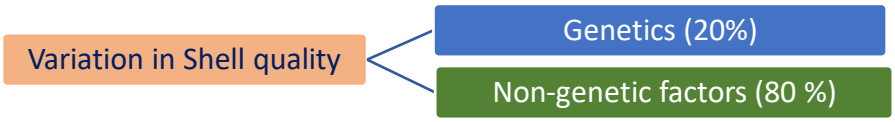


FIGURE: FACTORS AFFECTING SHELL QUALITY

6.1 Genetics



In BV300 breeding programme following shell quality traits are regularly measured and considered in the selection program to improve shell quality along with egg production and livability.

Breaking strength	Broken eggs
Candling hairline cracks	Egg shape
Pimples	Egg weight
Blood and meat spots	Double-yolk eggs
Shell colour	Asymmetry

6.2 Importance of Rearing

- Attaining the target body weight each week under ideal conditions is crucial for the complete development of the skeletal system.
- The skeletal system plays a role in maintaining stable shell quality throughout the laying cycle.

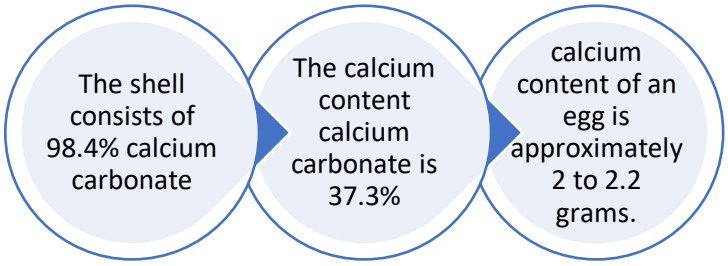
- Medullary bones, including ribs, shoulder bones, femur, tibia, and ulna, store labile calcium.
- While a major portion of calcium is derived from the diet, calcium from medullary bones is utilized for shell formation during egg laying when the digestive system is empty in the middle of the night.

6.3 Pre-lay Diet

- Providing a pre-lay diet starting fourteen days before the onset of production, coinciding with the development of the comb and wattles, helps establish medullary bone.
- From 0.5% production, it is recommended to switch to layer phase 1 feed.

6.4 Egg Weight Control

- Shell weight remains constant even as egg weight increases, resulting in thinner shells.
- By following the phase feeding approach outlined in the nutrition and management guide, it is possible to control egg weight without sacrificing production.



- Adequate calcium intake is critical for shell quality and egg production.
- Calcium source forms around 10% of the feed and is a cost-effective nutrient. However, it is important to procure good quality calcium sources that meet the specified requirements.

6.5 Calcium Particle Size

Follow the recommended calcium source size for different phases as mentioned in the guide (refer to page 15).

6.6 Feeding Time

- Shell formation is not a cell-mediated process but requires a constant transfer of calcium from supplying organs (bone and intestine) to ensure perfect eggshell formation.
- Adjusting feeding times can increase available calcium in the gut.
- Give one-third of the feed in the morning and two-thirds in the afternoon.

6.7 Phosphorus

- Inadequate dietary levels of phosphorus can reduce shell quality and egg production.
- High levels of dietary phosphorus can also be detrimental to shell quality.

- Increased plasma levels of phosphorus may reduce calcium mobilization from bones.
- Follow the phase feeding recommendations that gradually reduce phosphorus levels in each phase.

6.8 Vitamin D3

- Vitamin D3 plays a crucial role in shell quality.
- In the liver, vitamin D3 is activated to its first active metabolite, 25-OH-D3,
- In Kidney it is further converted to its biologically active form, 1,25-dihydroxy-D3, which is essential for calcium absorption from the intestine and calcium mobilization from bones.
- Vitamin D3 deficiency can result in the formation of eggs with poor shell quality.

6.9 Micronutrients

- Trace elements such as magnesium, manganese, copper, and zinc are important for shell quality.
- Use high-quality trace mineral supplements and follow the recommended guidelines.
- Organic forms of trace minerals are particularly beneficial for absorption, especially during the late laying cycle.

6.10 Season

- Summer has a significant effect on shell quality, which is further aggravated in aged hens.
- Reduced feed consumption during summer can lead to nutrient deficiencies.
- The loss of bicarbonate from the blood due to decreased carbon dioxide levels from increased respiration hampers shell formation.
- Follow consumption-based feed formulations to mitigate the effects of decreased feed intake during summer.
- Supplement sodium from sodium bicarbonate and maintain a Na and Cl ratio of 1:1.3.
- Additionally, add extra vitamin C at a rate of 200g/ton of feed under heat stress conditions.
- Refer to the summer feeding guidelines provided in chapter 7 (page 41) for more details.

6.11 Management

Managemental practices for better shell quality	
Frequent egg collection	2.0 mm wire cage floor is ideal
Preventive maintenance of cage floor and egg rolls	Ideal stocking density
7 degree slope of cage floor is preferred	Minimal handling of birds

6.12 Lighting and Midnight Snack

Follow the recommended lighting protocol outlined in the guide to improve shell quality (refer to chapter 10, page 46).

6.13 Diseases

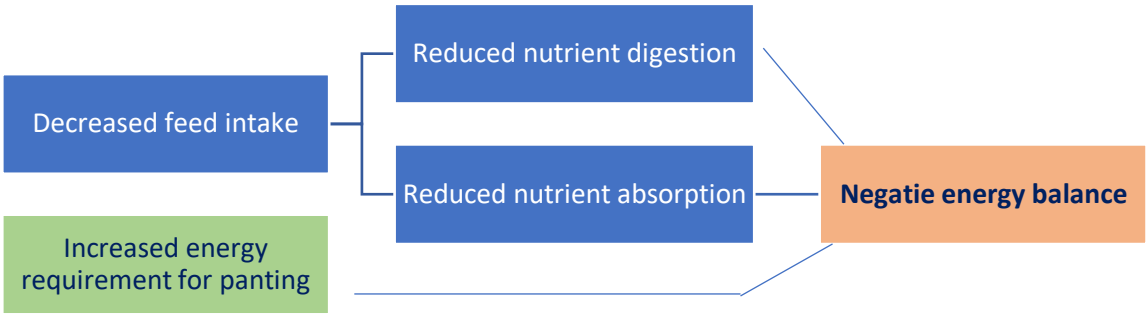
- Shell quality is affected by certain diseases such as
  - Infectious bronchitis
  - Newcastle disease
  - Adenovirus
  - Mycotoxin,
  - Worm infestation
- Proper disease prevention and control measures are necessary to maintain optimal shell quality.

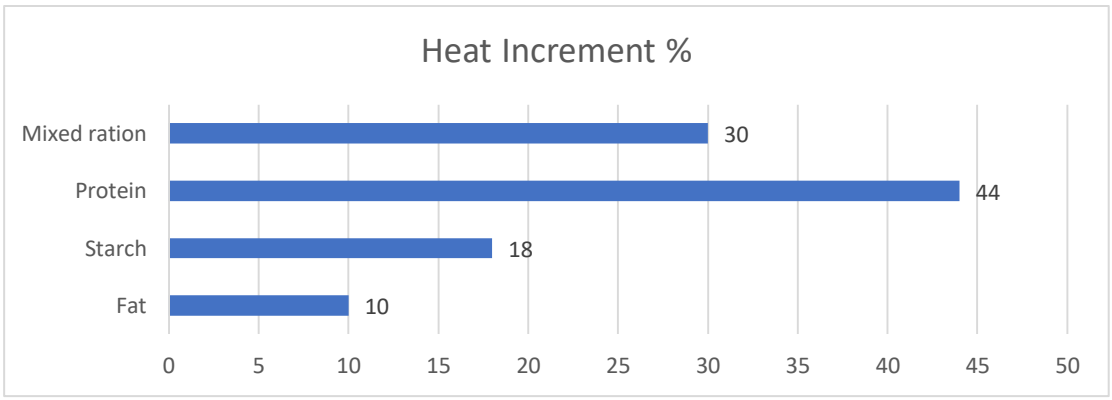
7. Summer Feeding

- The majority of laying hens are housed in open-sided houses, where heat stress can become a significant management challenge at some point during the production cycle.
- Heat stress can lead to reduced production, egg weight, shell quality, growth, and livability. However, appropriate management interventions can help minimize these effects.
- Birds don't have sweat glands, so they rely on evaporative cooling, such as panting, to lose heat in high temperatures.
- High temperature combined with humidity is more stressful for birds than high temperature alone.
- Other environmental factors like air speed and movement also play a role. Fluctuating day/night temperatures further increase stress levels in birds.
- Once the temperature exceeds 28°C (82°F), birds start panting and their blood vessels dilate.
- Heat stress becomes more severe when relative humidity is above 50%.

7.1 Energy

- The bird first meets its maintenance requirements, and energy deficiency negatively affects its performance.





- Increase the dietary metabolizable energy by up to 100 Kcal/kg by adding vegetable oil and replacing a portion of the grains. This will also enhance feed palatability and stimulate feed intake. However, ensure the oil is of good quality to prevent rancidity.

7.2 Protein

- Protein requirement remains independent of temperature.
- The protein and amino acid requirement are determined by egg mass.
- If a consumption-based formula is followed, the amino acid requirement of the bird can be met even with reduced feed consumption.
- Protein digestion generates significant heat production (44% heat increment), and protein absorption is also reduced under heat stress.
- It is recommended to feed high-digestible protein sources or increase the amount of synthetic amino acids.
- Adjust the amino acid content in the feed based on the actual feed consumption, as amino acids are primarily deposited in the eggs.

7.3 Vitamins and Minerals

- Partially replacing (30-35%) the supplemental dietary sodium chloride (salt) with sodium bicarbonate (1.5 kg/ton) is beneficial for shell quality and dietary electrolyte balance.
- Electrolytes can also be added to the drinking water.
- Vitamin E (100 mg/kg) and betaine (500 mg/kg) can help maintain osmotic balance, protect cells from dehydration, and reduce cortisol levels.
- When adding vitamins to the water lines, ensure proper dilution and pay attention to water quality before and after usage.

7.4 Feed Management

- It is highly recommended to avoid feeding birds during the warmest period of the day.
- Provide feed in the morning and late afternoon, ensuring that it is available to the birds in the morning.
- Frequent feeding during cooler times stimulates feed consumption.

7.5 Feed Particle Size

- Use layer feed with 80% of particles ranging from 0.5 to 3.2 mm.

7.6 Midnight Lighting

- Follow the midnight light protocol provided in the lighting program on page 49.

7.7 Calcium Management

- Follow the recommended protocol for optimal shell quality as given on page 38.

7.8 Water Quality and Management

- During periods of heat stress, laying hens will increase their water intake.
- Water quality is crucial during heat stress, as bacterial growth is rapid in hot and humid conditions.
- Provide ample fresh and clean water to encourage birds to drink, which in turn stimulates their appetite.
- Birds tend to consume more water towards the end of the day.
- Flushing water lines helps maintain the correct water temperature.
- Cooler drinking water helps birds tolerate high temperatures better.
- It is essential to protect water reservoirs and plumbing from direct sunlight.
- Daily water sanitation is crucial to maintain water quality and prevent waterborne infections.

8. Feed Toxicity

- During the rainy season, the toxicity of feed ingredients tends to increase. Prolonged rainy periods after harvest make it challenging to dry grains properly, resulting in high moisture content that favors the growth of mold and toxin production.
- Unfortunately, modern harvest equipment and grain storage facilities are often inadequate, exacerbating the issue.
- Additionally, the use of pesticides in grain storage can contribute to toxicity problems.
- Molds and fungi are prevalent in various farm environments and can have a significant negative impact on the health of birds. They can develop on feedstuffs during field growth, harvest, storage, and transportation. Mycotoxins, which are produced by these molds, tend to accumulate in the outer layers of cereals, making by-products more susceptible to higher levels of mycotoxins.
- In laying hens, mycotoxins can lead to reduced feed consumption, poor growth rates, decreased egg production, inefficient feed conversion, increased susceptibility to diseases, higher mortality rates, compromised eggshell quality, blood spots, pale yolks, reduced fertility and hatchability, as well as leg problems in young chicks.
- To minimize the presence of mycotoxins, it is recommended to implement a cleaning and/or sorting process for grains to reduce toxin levels.
- However, it's important to note that mycotoxins do not spread uniformly, and toxic hot spots may still be present even after such processes.
- Since mycotoxins are relatively heat-stable, heat processing is not a viable solution. Instead, adding a mycotoxin binder specific to the mycotoxin(s) present in the feed material is advisable.
- Various clay or natural adsorbents can be used to mitigate the toxic effects of fungal and chemical toxins in poultry diets.
- Substances like activated charcoal, alumino-silicates, bentonites, silicon and zeolites, and glucomannan have shown to be beneficial in reducing the toxic impact of feed mycotoxins.
- Hydrated sodium calcium alumino silicate (HSCAS) is particularly effective in binding toxins.
- Oils rich in polyunsaturated fatty acids (PUFA) also serve as potent adsorbents for fungal toxins.

9. Drinking water quality

- Water is an essential nutrient that often receives little attention.
- Poor water quality can interfere with digestion, affect bird performance, and serve as a potential source of pathogens.
- Moreover, the efficacy of vaccines and medications administered through water lines can be diminished when water quality is subpar.
- Therefore, it is important to maintain water free from bacteria, fungus, molds, algae, biofilm, scale, and within the recommended pH range.
- Regular monitoring of water quality is highly recommended.
- There is a strong correlation between feed and water consumption. Under normal conditions, birds consume 1.8 to 2 times more water than feed.
- During periods of heat stress, water consumption increases.
- Providing cool water and supplementing with electrolytes during the summer season improves water intake. This, in turn, increases feed consumption and enhances growth and performance during potential heat stress conditions.
- Monitoring daily water consumption through the use of water meters is an easy and effective tool for monitoring flock health. A decrease in water consumption can be an early indication of health issues in the flock.
- The quality of water also depends on its source. When using surface water as a drinking water source, caution must be exercised due to the risk of contamination from wild bird droppings.
- It is recommended to use a closed water system that minimizes the chance of external contamination.
- Follow proper water sanitation program.
- Regularly clean and disinfect water system in the shed.
- It should be disinfected after each flock and every time water medication is administered in the presence of birds.
- Regular flushing with high pressure and appropriate disinfectants helps reduce the formation of biofilm in the nipple lines.
- It is also important to protect water tanks and pipelines from direct sunlight.

Table-16: Recommended Drinking Water quality parameters.

Parameters	Recommended Level	Parameters	Recommended Level
Physical parameters	Clear, colorless, odorless	Chlorides, mg/lit	<200
Total Bacteria count, CFU/ml	<50	Copper, mg/lit	<0.5
Total Coliform, CFU/ml	0	Fluoride, mg/lit	<1.5
pH	6.5 – 7.5	Iron, mg/lit	<0.3
Total Dissolved Solids, ppm	<1000	Magnesium, mg/lit	<50
Total Hardness, ppm	60 - 180	Manganese, mg/lit	<0.05
Salinity, ppm	<1000	Nitrates, mg/lit	<25
Oxygen Reduction Potential (ORP), mV	650 -750	Nitrites, mg/lit	<4
Ammonium, mg/lit	<0.5	Sodium, mg/lit	<50
Arsenic, mg/lit	<0.05	Sulfate, mg/lit	<250
Calcium, mg/lit	<60	Zinc, mg/lit	<1.5

10. Lighting programme

The lighting schedule plays a crucial role in the successful management of both rearing and laying periods, significantly impacting egg production and egg weight.

To achieve optimal results based on factors such as geographical area, season, and market demand for egg size, it is recommended to consult local BV300 representative for a precise lighting schedule tailored to your specific needs.

However, this guide provides general guidelines specifically for open-sided poultry houses.

The fundamental principle of lighting

1. Avoid increasing the hours of light (photoperiod) during the rearing period
2. Avoid decreasing the hours of light during the production period.
3. Mid-night lighting is exception to the above rule.

10.1 Rearing

When the day-old chicks arrive on the farm, it is important to provide them with the right amount of light to help them adjust and recover from the stress of being handled in the hatchery and during transportation. Here's a simple lighting schedule to follow:

Age in weeks	Total Light (Hours)
1	24:00 - 22:00
2	20:00
3	20:00
4	20:00
5	20:00
6	20:00
7	20:00
8 weeks to stimulation	Natural Light

0 to 3 days — 24 hours light

- During the first three days, keep the lights on for 24 hours continuously.
- This ensures that the chicks have enough light to see and find their food and water easily.

4 to 7 days — 22 to 23 hours light

- From the fourth day to the seventh day, reduce the lighting to 22 to 23 hours a day.
- This slight decrease in light gives the chicks some time to rest while still providing enough light for them to eat and drink comfortably.

2 to 7 weeks — 20 hours light

- Starting from the second week until the seventh week, provide the chicks with 20 hours of light each day.
- However, make sure to include a 4-hour dark period between 7:30 PM and 11:30 PM.
- This dark period is essential to give the chicks a chance to rest and sleep.

8th week onward — No artificial light

- From the eighth week onwards, you can rear the birds without any artificial light.
- Allow them to follow the natural day length, without additional lighting.

10.2 Stimulation and Laying period.

- The amount of light birds receive can affect their growth and egg production. Without enough light or when the days become shorter, the birds mature later and produce fewer eggs. The timing of sunrise and sunset controls their reproductive cycle, which usually happens every 24 hours.
- Since body weight is important for determining egg weight, the timing of light stimulation should be based on birds' body weight.
- **When the body weight reaches 1200 grams or 10% production which ever is earlier, start using artificial light for stimulation.**

Age in weeks	Total Light (Hours)
17	Body weight >1200g
18/19	+1 Hour
19/20	+30 minutes
20/21	+30 minutes
21/22	+30 minutes
22/23	+30 minutes
23/24	+30 minutes
24/25	+30 minutes

-To stimulate the birds effectively, add 1 hour of light during the first week of stimulation. This extra hour can be divided into two parts, with a 3-4 day interval between them.

-In the following weeks, increase the light by 30 minutes each week until a maximum of 16 hours of light is reached. This total light duration is generally divided between morning and evening.

Total Artificial light (16 hours)

- **Morning light:** switch on the lights at 4:00 am and turn them off at sunrise.
- +
- **Evening light:** switch on the lights at sunset and turn them off at 8:00 pm.

Light intensity

Brooding period
- **Higher light intensity (30 -40 Lux).**
- Helps young chicks see their surroundings better and encourages activity, feeding, and drinking.

Growing and Laying period
- **Lower light intensity (10 - 20 Lux).**
- Creates a calmer environment, reduces stress, and minimizes aggressive behaviour among the birds.

10.3 Mid-night snack

- During the rearing period, if the birds' body weight is below the desired target because they are eating less (specially in summer months), and all other options have already been tried, give them up to two hours of extra midnight light.
- In the laying period, to improve the birds' feed consumption and the quality of their eggshells, two hours of light during the midnight hours can be given.
- **But it's important to make sure there is a dark period of three hours before and after the midnight light. This can be given at any age after 7 weeks of age when no artificial light is given.**
- It's also crucial to ensure the birds have access to both feed and water during this period. Feeding / moving feed trollies / stirring of feed improves results.
- Withdrawal of mid-night light should be done gradually by reducing 15 minutes per week whenever it is not required.

10.4 Sunrise, Sunset and Day length

- Sunrise/ sunset time and daylength periods of major poultry pockets are given in table 17, page 49.

Key points

- ☞ Use good quality timer/time switches in sheds.
- ☞ Routine cleaning and maintenance of light sources is necessary.
- ☞ Replace burnt / fused lamps immediately.
- ☞ Response of light stimulation depends on flock health, nutrition and season.

Table -17: Sunrise, Sunset, and Day length of major poultry pockets

Month	Namakkal			Bangaluru			Hyderabad			Vijaywada			Pune			Anand			Chandigarh		
	Sunrise	Sunset	Day Length	Sunrise	Sunset	Day Length	Sunrise	Sunset	Day Length	Sunrise	Sunset	Day Length	Sunrise	Sunset	Day Length	Sunrise	Sunset	Day Length	Sunrise	Sunset	Day Length
Jan	06:41	18:13	11:32	06:46	18:12	11:26	06:50	18:02	11:12	06:39	17:54	11:15	07:09	18:17	11:08	07:21	18:15	10:54	07:21	17:43	10:22
Feb	06:38	18:25	11:47	06:42	18:26	11:44	06:43	18:18	11:35	06:34	18:10	11:36	07:02	18:35	11:33	07:10	18:35	11:25	07:04	18:10	11:06
March	06:25	18:28	12:03	06:27	18:30	12:03	06:25	18:26	12:01	06:16	18:17	12:01	06:43	18:44	12:01	06:47	18:47	12:00	06:34	18:31	11:57
April	06:06	18:29	12:23	06:07	18:32	12:25	06:01	18:32	12:31	05:53	18:23	12:30	06:18	18:51	12:33	06:19	18:59	12:40	05:56	18:50	12:54
May	05:55	18:33	12:38	05:54	18:38	12:44	05:44	18:41	12:57	05:37	18:31	12:54	06:01	19:01	13:00	05:58	19:11	13:13	05:28	19:10	13:42
June	05:54	18:41	12:47	05:54	18:47	12:53	05:42	18:52	13:10	05:35	18:41	13:06	05:57	19:12	13:15	05:53	19:24	13:31	05:19	19:27	14:08
July	06:02	18:45	12:43	06:01	18:50	12:49	05:50	18:54	13:04	05:43	18:44	13:01	06:06	19:14	13:08	06:02	19:26	13:24	05:30	19:27	13:57
August	06:07	18:37	12:30	06:08	18:41	12:33	05:59	18:42	12:43	05:51	18:33	12:42	06:16	19:02	12:46	06:15	19:10	12:55	05:49	19:06	13:17
September	06:07	18:18	12:11	06:09	18:21	12:12	06:04	18:19	12:15	05:56	18:10	12:14	06:22	18:37	12:15	06:25	18:42	12:17	06:07	18:29	12:22
October	06:07	18:00	11:53	06:10	18:01	11:51	06:09	17:55	11:46	06:00	17:47	11:47	06:28	18:12	11:44	06:35	18:13	11:38	06:25	17:52	11:27
November	06:13	17:50	11:37	06:18	17:50	11:32	06:21	17:40	11:19	06:11	17:33	11:22	06:40	17:57	11:17	06:51	17:55	11:04	06:49	17:26	10:37
December	06:28	17:56	11:28	06:34	17:56	11:22	06:38	17:44	11:06	06:28	17:37	11:09	06:58	18:00	11:02	07:10	17:56	10:46	07:12	17:23	10:11

11. Management

BV300 commercial layers can be successfully raised either on the floor or in cages. Both methods have their own advantages.

11.1 Space Requirement

The stocking density, or the number of chicks placed in a given area, is an important consideration that balances economics and performance.

Overcrowding the chicks can negatively impact their performance and overall results.

Table: Recommended minimum floor and feeder space requirement

Period=>	Brooding		Growing	
Age=>	0 to 8 weeks		9 to 15 weeks	
Rearing System=>	Floor	Cages	Floor	Cages
Floor space/bird	Up to 3 weeks : 0.30 - 0.40 sqft 4 to 8 week : 1.00 sqft	40 sq inch	1.5 sqft	60 sq inch
Feeder space/bird	5 cm	5 - 6 cm	7.5 cm	10 cm

11.2 Before chicks' arrival and placement

- To get ready for the arrival of chicks, it's important to thoroughly clean and disinfect the house and all the equipment at least 2 weeks in advance as per the approved protocol.
- Before the chicks arrive, it's also necessary to preheat the brooding house for at least 24 hours. This ensures that all the equipment (cages), the floor, and the litter material, are warm when the chicks are placed.
- Just before placing the chicks, make sure to fill the drinkers or nipple lines with clean and fresh water. Chicks need access to water right from the start. Also, provide them feed three hour after giving water.

11.3 Temperature, Humidity and Ventilation

The first few days of life is critical for chicks, as their thermoregulatory system is not fully developed so they can't control their body temperature very well until they're about two weeks old. That's why they rely on external heat sources like spot brooders or space heaters to keep warm. Proper brooding is crucial because it helps the chicks develop their immune system. It creates the right conditions for their growth and health.

- During the first 24 hours, it's important to closely watch the chicks and see how they behave. If needed, you can adjust the temperature to make sure they're comfortable.

- Maintain a minimum Relative Humidity (RH) of 40% by installing fine spray fogger line.

Age	House Temperature
1 week	33 – 35 °C (91 – 95 °F)
2 week	30 – 32 °C (86 – 90 °F)
3 week	29 – 30 °C (84 – 86 °F)
4 week	28 – 29 °C (82 – 84 °F)

- Adequate ventilation is also necessary in the brooding area. It helps to keep the air fresh and removes carbon dioxide and ammonia from the shed.
- To ensure proper ventilation, it's recommended to leave a gap or window of about 3-5 inches between the ceiling and side curtains.
- Giving chicks the best start in life is crucial.

11.4 Crop fill

- A good measure of successful chick start is crop fill.
- The goal is to have their crops, which is like their food storage, full as soon as possible after they are placed.
- Target more than 95% of the chicks to have a full crop within 24 hours after being placed. This achieves good early uniform body weight as per the target.
- If the brooding temperature is too high or too low, it can affect the percentage of chicks with a full crop. So, it's important to make sure the temperature is just right to encourage proper feeding and crop filling in the chicks.

11.5 Lighting

It is critical to provide correct and uniform light intensity throughout the house to ensure that chicks can feed and drink easily. During the first three days, it is recommended to have 24 hours of light with a minimum intensity of 20 to 30 Lux Follow recommended lighting program given in chapter 10 (page 46) of this guide.

11.6 Beak Treatment

Beak treatment is a critical and the most important operation during the rearing period and it should be carried out by well trained and skilled operators.

The beak treatment reduces:

- Feed wastage
- Feather pulling
- Cannibalism/ pecking

11.6.1 Single beak treatment

- This should be done when chicks are between 7 to 10 days old using a precision beak trimmer.

- To perform the treatment, hold the chick gently in one hand by pressing the thumb lightly against the back of the chick's head and forefinger at its throat to hold back the tongue. Tilt the chick's beak upwards at a 15 degree angle above horizontal and cauterize properly to avoid unequal re-growth.
- Choose a beak treatment hole size of 5.5 mm diameter to make the cut 2.5mm in front of the nostril.
- Cutting the beak too severely may harm the chicks and impact their performance.
- For proper cauterization, a blade with a cherry red color and a temperature of approximately 620°C (1150°F) is recommended.

11.6.2 Double beak treatment

- In some farms, two beak treatments may be required during the growing period. The first treatment should be done at 7 to 10 days of age, and the second at 8 to 9 weeks of age.
- The first treatment should be less severe. Use a beak treatment hole size of 4.5 mm diameter and a blade temperature of 540°C (1000°F). Make the cut 3 mm in front of the nostril and cauterize properly.
- For the second beak treatment at 8 to 9 weeks of age, use a manual beak trimming machine.
- Treat the upper and lower beak separately. Cut the upper beak 5 to 6 mm in front of the nostril. The lower beak should be cut so that it is 1 mm longer than the upper beak.
- Position the head 10 to 15 degrees below horizontal for the upper beak and nearly horizontal for the lower beak. Use a blade temperature of 675°C (1250°F) for proper cauterization.

11.6.3 Precautions

Here are some important precautions to take during beak treatment:

- Before conducting beak treatment, make sure that the flock is healthy.
- Withdraw feed from the birds 8 to 10 hours before the beak treatment.
- Provide water with water-soluble preparations containing vitamin K, vitamin C, and electrolytes for two days before and two days after beak trimming. These preparations assist in blood clotting, reduce stress, and prevent dehydration.
- Administer analgesic medication (such as Paracetamol or aspirin) for two days during the operation.
- Immediately after beak treatment, dip the beak in ice-cold water. This helps soothe the area and reduce any potential inflammation.
- Keep the feed at a high level for a few days after beak trimming and ensure that the birds have access to an ample supply of clean water.
- Take precautions during cauterization to avoid bleeding. Proper cauterization techniques should be used, and any bleeding beaks should be re-cauterized promptly.

11.7 Feeding management

- Spread paper sheets or corrugated paper on the bottom of the cage or over the litter material for the first one or two weeks.
- Place a small amount of feed on the paper sheet so that it's easily accessible to the chicks. This helps them find and eat their food without any difficulty. These paper sheets may be removed after one or two weeks.
- It's important to feed the chicks frequently in small volumes. This stimulates their appetite and encourages them to eat more.
- Consider using mini (baby) feeders for the chicks. These feeders are designed to minimize feed wastage and prevent contamination from fecal material.
- Use baby waterers to provide clean and accessible water to the chicks.

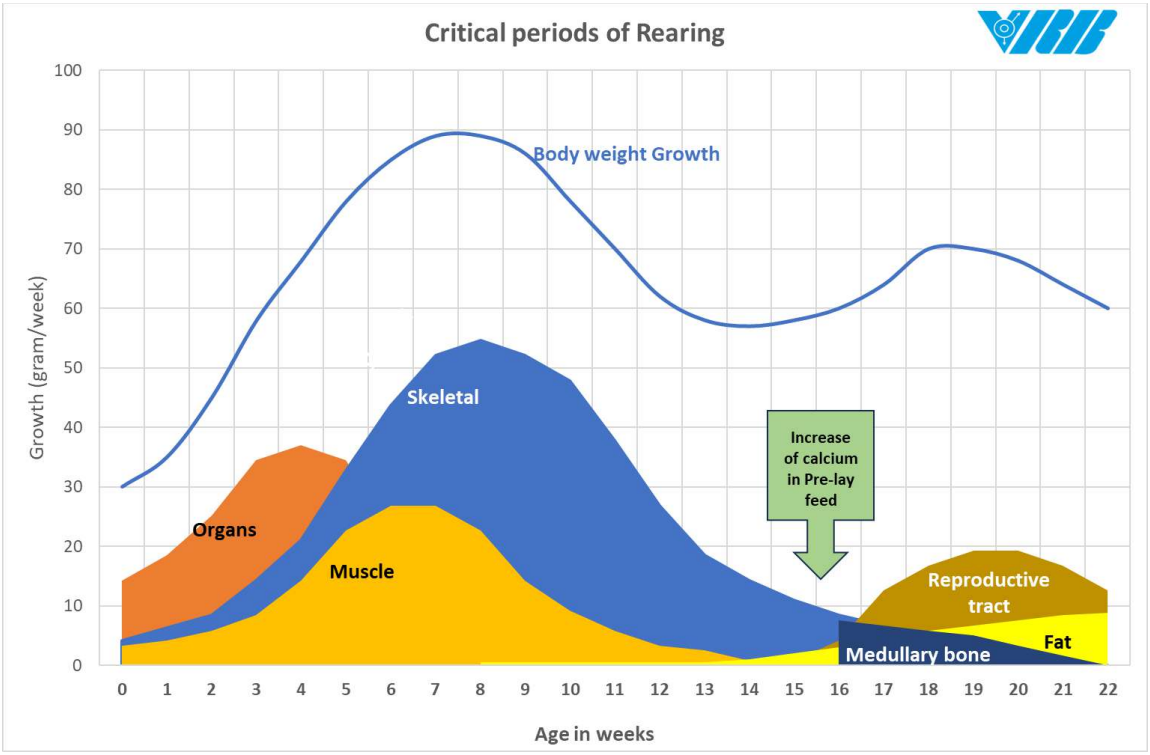
11.8 Body weight and its monitoring

The way a chick's body weight develops during the growing period is very important. You can find the standard body weight and the weekly body weight gains during the rearing period in Table 1 and Figure 2 of Chapter 3 (page 10).

There are key factors to consider in body weight development:

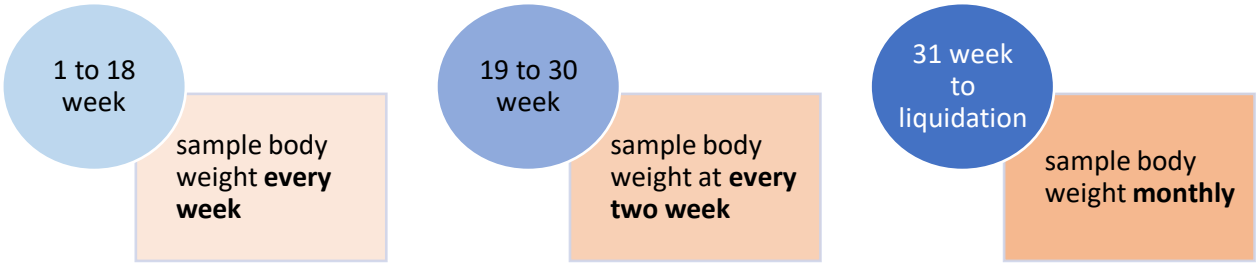
a. **Achieving target body weight by the age of 6 weeks.**
b. **Aim for the desired body weight and uniformity at the 10/15 weeks of age.**
c. **The body weight should increase by at least 300 grams between the start of egg production and the peak production.**

In the body weight development during the first 6 weeks of age, the focus is mainly on organ development. If there are any delays in growth during these initial weeks, it can lead to reduced body weight at 15 weeks and can affect the overall performance of the flock. That's why it's crucial to follow the recommended nutrient levels mentioned in this guide.



There is a strong connection between early egg weight and the bird's body weight development during the growing period. The better the body weight development during this time (meaning the bird has a strong body frame), the larger the eggs will be during the early production phase.

It's important to monitor the body weight of the flock regularly to track their growth. This helps us identify any abnormal weight gain and take necessary corrective actions. L**ate attempts to correct low body weight are not efficient at improving body composition and frame size.**



- It's recommended to randomly select and mark specific cages in different parts of the house. Weigh the birds from the same cages every week to get accurate information about their weight gain and uniformity. In a deep litter system, take random samples from all pens.
- During the initial three weeks, measure the combined weight of a total of 100 chicks distributed among ten boxes, with each box containing 10 chicks. Starting from the fourth week, record the weight of each individual bird.
- Use a digital scale or a dial type weighing scale with an accuracy of less than 20 grams. Before weighing the birds, make sure to check and calibrate the scale using a standard weight bar.
- Determine the average weight of a flock and compare it with the standard weight.

Uniformity:

Uniformity refers to the similarity in weight among the birds.

To calculate it, determine the percentage of birds weighing within ± 10% of the mean body weight. This can vary depending on the accuracy of the weighing scale.

A higher percentage of pullets weighing within the ± 10% range indicates better uniformity.

Flocks with higher uniformity in weight tend to peak higher and produce more eggs.

Flocks with a wide variation in weight may not perform as well.

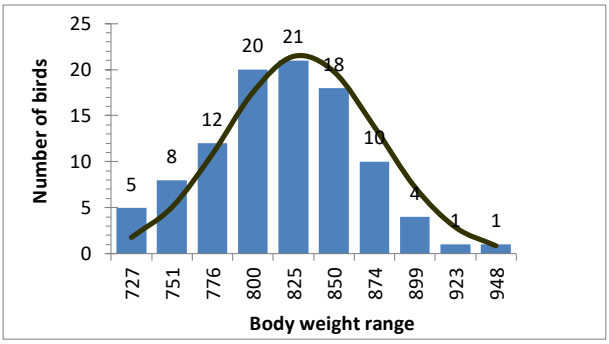
% of pullets within 10% of average flock weight	Uniformity rating
85% and over	Excellent
80 – 85 %	Very Good
75 – 80 %	Fair
Less than 70%	Not Satisfactory

Underweight birds or low uniformity in the flock could indicate overcrowding, insufficient feeder/water space, disease conditions, improper beak trimming, or inadequate nutrient intake. Identify and correct the underlying problem.

By regularly monitoring the body weight and ensuring good uniformity, you can optimize the growth and performance of the flock.

Uniformity% = No. of birds within range of ± 10 % of the mean wt x 100
Total birds weighed

☞ Illustration of body weight uniformity calculation



Sample size	100	
Average Body weight	830	gram
Mean + 10%	913	gram
Mean – 10%	747	gram
Number of birds outside 913 and 747 gram	7	
Uniformity = ([100-7]/100) x 100	93	%

11.9 Transfer

- Moving birds from one location or shed to another can be a stressful experience for them. It involves changes in their surroundings and the equipment they are used to. It's important to complete this transfer process before the hens start laying eggs, as the stress during and immediately after the transfer can have negative effects.
- The reproductive organs of the hens, such as the ovaries and oviduct, go through significant development in the two to three weeks leading up to the first egg being laid.
- To ensure proper development, it is recommended to schedule the transfer before onset of production.
- To minimize the stress during this period, it's beneficial to provide supportive care. This includes giving them water-soluble vitamins, probiotics, and vitamin C for three days before and three days after the transfer.
- For a period of two days, provide continuous 24-hour lighting, as it helps the chickens adjust to their new environment.
- Additionally, it's important to administer an anticoccidial treatment, like Amprolium, just before the transfer. Coccidiosis can lead to necrotic enteritis, a condition that affects production and increases mortality.
- Any sexing errors should be removed at transfer.

12. Disease prevention: Disinfection & Bio-security

Effective disease prevention requires an appropriate site selection, ensuring unit/farm isolation, implementation of thorough disinfection protocol and stringent biosecurity measures, and following suggested vaccination schedule. These measures are essential to prevent disease spread within the farm, leading to a profitable business operation.

12.1 Location, layout and shed design

The following factors must be considered during site selection, farm layout and shed design:

- Situating the farm at a considerable distance from other poultry operations and villages.
- Ensuring proper road access, ample high-quality water supply, optimal air circulation, moderate climate, and reliable electricity availability.
- Isolating rearing facilities from laying facilities. Adhere to the "**all in – all out**" principle.
- For laying units, maintain minimal age groups.
- Erect a secure perimeter fence with a solitary entry point for personnel and vehicles. Separating the residential area from the farm.
- Providing vehicle wash and changing facilities at the main entrance.
- Maintaining at least a 100-foot gap between two sheds.
- Designing poultry houses according to the specific climatic conditions of the region.
- Orienting the shed in an East-West direction to reduce direct exposure to sunlight.
- Incorporating a 4 to 5-foot overhang roof and a 2-foot rat-proof platform on all sides.
- Incorporating windows in gable walls for improved ventilation.
- Installing ¾ square inch chain link mesh on both sides of the house, including beneath the rat-proof portion of the shed.
- Including an open ridge in the roof for effective hot air movement during summers.
- Ensuring sparrow-proofing at the eaves and open ridge of the roof.
- Ensuring shed construction facilitates easy and thorough cleaning and disinfection between flocks.

12.2 Bio-security Program

A robust bio-security program involves identifying and controlling potential avenues through which diseases could enter the farm.

12.2.1 Personnel Hygiene and Movement

- Restricting farm access to essential personnel only.
- Allowing entry at a central point, with visitors logging their visits.
- Prohibiting access to those who have been on other poultry facilities within the last 48 hours.

- Prohibiting sales representatives from visiting the farm.
- Preventing entry of vehicle drivers into the poultry houses.
- Banning personnel from other poultry farms.
- Enforcing a dress code for cull workers and preventing their entry after culling activities.
- Regular health check-ups for farm personnel.
- Providing clean clothing and footwear for all farm workers and visitors.
- Limiting workers to a single house ideally; supervisory movement between sheds after adhering to bio-security measures.
- Minimizing external teams or equipment use for tasks like vaccination, beak treatment or transfer.
- Prioritizing visits from younger to older flocks and from healthy to sick flocks, with no visits after interacting with sick flocks.

12.2.2 Vehicle movement and disinfection

- Maintain dedicated vehicles for inside and outside the farm. Load feed, materials, and chick boxes onto inside vehicles at the main gate.
- **Prevent cull vehicles from entering the farm.** Park these vehicles at least 2 km away and wash them at a designated washing center before bringing them to the loading place.
- Maintain a safe distance between vehicles during loading the culls. Disinfect farm vehicles and tyres before leaving the loading area and upon entering the farm.
- Maintain a vehicle register to control unnecessary vehicle movement.
- Thorough washing and disinfection of any vehicle entering the farm premises or residential areas within the farm.
- If using a vehicle dip, change the disinfectant water daily.

12.2.3 Disinfection Room

- Provide a closed room near the main gate for disinfecting incoming external materials.
- Disinfect the material through fumigation or fogging with recommended disinfectants.

12.2.4 Changing Facilities

- **Centralized Changing:** Prohibit employees from changing clothes at their homes. Provide separate changing rooms near the farm entrance for staff, male workers, and female workers.
- **Disinfection Procedures:** Fog all employees with a fine disinfectant solution mist before entering the changing rooms. Separate the changing room into dirty and clean areas. Offer lockers for personal items. Employees should change from civil clothes to clean uniforms in the clean area after thorough bathing.
- **Laundry Procedures:** Wash used uniforms daily using industrial washing machines with hot water.
- **Cleaning:** Clean the changing rooms daily after all employees have entered the farm.
- **Bathing Requirement:** Emphasize the need for a second bath if an employee leaves the farm premises.

12.2.5 Hand Wash and Foot Dip

- ✓ Sanitation Stations: Place hand wash and foot dip stations at the entrance of each shed. Mandate the use of foot dips during shed entry and exit.
- ✓ Disinfectant Usage: Utilize a disinfectant solution such as SafeGuard for foot and hand washing.
- ✓ Solution Maintenance: Change the disinfectant solution daily.
- ✓ Dedicated Footwear: Provide dedicated inside footwear for shed use. Employees should remove outdoor footwear before entering the shed.

12.3 Shed Cleaning and Disinfection Process

Upon completion of flock transfer or liquidation, it is imperative to initiate a comprehensive cleaning and disinfection process for both the poultry house and its equipment. Conducting this cleaning and disinfection routine between flocks is instrumental in diminishing the risk of infection for incoming flocks.

The complete shed cleaning and disinfection program can be broadly segmented into three primary stages as follows:

Dry cleaning → Wet cleaning → Terminal Disinfection

(I) Cleaning of Sheds (Brooding, Growing and Laying):

SR	ACTIVITY	DETAILS			
	A. Dry Cleaning				
1.	Insecticide Spray inside shed	Butox @ 2 ml/ ltr. Or Malathion50% @ 6ml /lit			
2.	Removal of litter and dispose off outside	Manual/machine			
3.	Shed repairs if any (Curtain/Pipe repairing/ Nipple replacement/ Electricity/ Floor levelling/ Mesh repairing etc.)	Maintenance			
4.	Cleaning of shed surroundings (Minimum 10 ft. around)	After grooming the area spray VBFA-400 @ 5 ml/ ltr.			
5.	Remove detachable equipment.	Drinkers/ feeders			
	B. Wet Cleaning				
1.	Wash inside of house with Cleaner.	UBC@ 4 ml/ ltr.			
2.	Wash down curtains properly.	UBC@ 2 ml/ ltr.			
3.	Wash/ Clean equipment	Aquamax@ 50 ml/ ltr.			
4.	Descaling, cleaning and disinfection of pipeline (100 ft. pipeline length) 5% Aquamax. Give 12 hours of contact period. Open and clean Nipple line Regulators/constant head tank for bio-film removal. Check water for Bacterial counts in lab.	**Pipeline Diameter (inch)**	0.50	0.75	1.00
		Aquamax (ml)	250	500	750
		Water (liter)	5	10	15

(II) Disinfection of Shed (Brooding):

C. Terminal Disinfection		
1.	Brooding arrangements	Put down curtains, litter bedding, cage paper, drinkers & feeders
2.	Terminal disinfection by thermal fogging with curtains down.	VBFA-400 @ 2 lit. in 3 lit. of water for 3000 sq. ft. area
3.	Spray two days before chicks arrival	Bio-buster @ 5 gm/ ltr. (For 125 sq. ft. area)
D. Continuous Disinfection		
1.	Spray in presence of birds	Bio-buster @ 5 gm/ ltr. (For 125 sq. ft. area) on rotation basis with B-904@ 4 ml/ltr.
2.	Water Sanitation	$BVClO_2$ Tablet (10gm) @ 1 Tab/ 2000 litre of water **OR** Safegard@ 1 ml/ 10 ltr. of water
3.	Dead bird disposal pit, removal of biofilm in the pipelines	Maintenance
4.	Regular cleaning of pipeline for removal of biofilm	

a) Grower Shed: Disinfection (Cleaning of shed : as described in point No (I)

SR	ACTIVITY	DETAILS
1.	Disinfection of Grower shed before shifting of birds	Spray VBFA-400 @ 5 ml/lit. of water (for 25 sq.ft area) In case of deep litter, thermal fogging with VBFA-400 @ 2 lit. in 3 lit. of water for 3000 sq. ft. area
2.	Continuous disinfection: Disinfectant spray in presence of bird twice a week	Bio-Buster@ 5 gm/ltr. (For 125 sq. ft. area) on rotation basis with B-904 @ 4 ml/ltr.
3.	Water Sanitation	$BVClO_2$ Tablet (10gm) @ 1 Tab/ 2000 litre of water **OR** Safegard@ 1 ml/ 10 ltr. of water

a) Layer Shed: Disinfection (Cleaning of shed : as described in point No (I)

SR	ACTIVITY	DETAILS
1.	Proper Cleaning & Disinfection of Layer shed before shifting of birds	After proper cleaning, spray B-904 @ 4 ml/lit. for 25 sq. ft. area **OR** Thermal fogging with B-904 @ 2 lit. in 3 lit. of water for 8000 sq. ft. area
2.	Continuous disinfection: Disinfectant spray in presence of bird twice a week	Bio-Buster@ 5 gm/ltr. (For 125 sq. ft. area) on rotation basis with B-904 @ 4 ml/ltr.
3.	Water Sanitation	$BVClO_2$ Tablet (10gm) @ 1 Tab/ 2000 litre of water **OR** Safegard@ 1 ml/ 10 ltr. of water.

The down-time period commences once the shed has been meticulously cleaned and terminal disinfection has been satisfactorily carried out. This down-time should span a minimum of two weeks.

12.4 Disposal of Dead Birds

- It is essential to establish a closed postmortem room and a designated disposal pit or incinerator, situated away from the poultry sheds.
- Hygienically dispose of dead birds using a well-designed pit or incinerator, adhering to governmental regulations.
- Avoid storing dead birds in the feed room; instead, utilize dedicated disposal bins for this purpose.
- Assign a responsible individual to oversee tasks such as collecting dead birds from all sheds, maintaining the postmortem room's cleanliness, operating the incinerator, and managing the waste disposal area.

12.5 Manure Disposal

- When managing manure disposal, take the following precautions:
- Remove manure from the sheds and transport it away from the farm.
- Use closed containers, bags, or covered trolleys to prevent spillage on farm roads.
- Carry out the process cautiously and promptly.
- Adhere to vehicle bio-security guidelines.

12.6 Integrated Fly Management.

Flies can be a big problem on poultry farms. The most common fly species associated with poultry manure is the house fly. House flies can carry disease-causing organisms and cause nuisance complaints from nearby communities. To control fly populations, different management practices can be followed:

12.6.1 Cultural/Physical Control:

- Keep the manure dry: Flies lay their eggs in moist manure, so reducing moisture content to around 30% makes it less attractive to them. Proper ventilation is important to keep the manure dry.
- Remove manure regularly: Taking out manure at least once a week prevents flies from breeding and interrupting their life cycle. This requires enough space for spreading or suitable facilities for holding and composting manure.
- Prevent water leakage: Repair any leaks in the water system to avoid excess moisture in the manure. Also, prevent rainwater seepage into the manure.
- Use a manure belt: If your farm uses a manure belt system, remove the manure from the belts two to three times per week. Flies are attracted to fresh manure on the belts, and if it's not removed quickly enough, fly maggots can develop. These flies can then continue developing in manure storage areas.

- Keep the manure liquid: Adding water to the manure and keeping it in liquid form makes it less suitable for fly breeding. Concrete floors can help with this method, although it may cause issues with smell, loss of manure income, and disposal of liquid manure.
- Salt content in feed: Avoid high salt content in the feed and treat the flock for loose droppings.
- Maintain sanitation: Remove dead birds daily and dispose of them properly. Minimize spilled feed and broken eggs, as they attract flies. Keep the grass and weeds around the poultry houses mowed to eliminate resting areas for adult flies and promote airflow.

12.6.2 Biological Control:

Beneficial parasites and predators: Dry manure accumulations support populations of parasites and predators that control fly breeding. By maintaining dry manure, removing it during cooler months when flies are less active, staggering manure removal over a few weeks, and minimizing the use of insecticides, you can preserve these natural enemies.

Some products can be added to the feed or sprayed on the litter to make it less attractive to flies.

Table – Examples of available products for litter management to control flies

Brand Name	Active ingredients	Manufacturer	Application method
Fly Over	Herbal	Exotic Biosolutions Pvt Ltd	Feed
FLYEX	Herbal	Exotic Biosolutions Pvt Ltd	Feed
FlyTrol	Herbal	Envizon Bioscience	Feed
Larv-o-check	Probiotic	Zenex Animal Health	Feed
Certilus Eco	Probiotic	Arm and Hammer	Feed
Liiteron+	Plant extract	Guybro Chemicals Pvt Ltd	Spray
Littor clean	Probiotic and yeast	Nuvem Animal Care Pvt Ltd	Spray
DRYLTT	Diatomeceous earth	AVIANS	Sprinkled on wet manure patches
HenGuard-0	Natural minerals & herbals	Econat Industries	Sprinkle/dusting
FlyTrol-DRY	Herbal	Envizon Bioscience	Sprinkle/dusting
Litterman Dryer	Enzyme	Anshuman Industries	Spray

12.6.3 Mechanical Control:

Fly traps, sticky tapes, and electric insect killers: These methods capture or kill flies. Fly traps and glue strips catch flies, while electric insect killers zap them. Mechanical burning involves burning flies in their resting areas.

Table- List of products available for mechanical fly control

Method	Brand Name	Manufacturer
Trap	Barrix catch	Barrix Agro Sciences Private Limited
	E-Trap	Nutricon Bioscience
	House fly trap-chipku	Turning point natural care
Sticky tape	Fly-end	Saife vetmed
	House fly reel	Turning point natural care
	SEIZE	SKN Biotech India (P) Ltd

12.6.4 Chemical Control:

Chemical control should be used alongside other methods. Insecticides can be applied to control flies at different stages of their life cycle. It's important to apply them selectively to avoid killing beneficial fly predators and parasites. Rotate insecticides every 6 to 8 weeks with different modes of action or active ingredients to reduce the risk of resistance.

There are four main types of chemical control methods for flies:

12.6.4.1 Insect Growth Regulators (IGRs) like Cyromazine can also be used. They are incorporated into the poultry feed to prevent the development of fly larvae in the manure. IGRs have a selective mode of action that does not harm natural fly predators. When introducing a new flock to layer sheds or when fly populations increase in caged layer flocks, IGRs can be used for 4 to 6 weeks. If fly populations continue to rise, the treatment can be repeated after a 4 to 6-month interval. However, it's important to avoid relying too heavily on this product as it may lead to the development of resistance.

Table- Examples of insect growth Regulator brands available for fly control

Brand Name	Active ingredients	Group/class	Manufacturer
Larva Ban	Cyromazine 2%w/w & Kaolin	Triazine	RR Animal Health Care Ltd
Larvadex	Cyromazine 2%w/w	Triazine	ELANCO
Larvadex Gold	Cyromazine 2%w/w + Chlrohydroxyquinoline 24% w/w	Triazine	ELANCO
Larvanil Forte FS	Cyromazine 2.0 %	Triazine	Neospark
Larvend FS	Cyromazine 2.0 %	Triazine	Reddy Drugs Laboratories
Larvistat Gold	Cyromazine + plant extract	Triazine, plant extract	Provet
Larvistat super	Cyromazine 8%, Halquinol 48% Allicin 2% Zeolites	Triazine, antimicrobial	Provet
No Fly	Cyromazine 1.0 %	Triazine	Varsha Labs

12.6.4.2 Larvicidal sprays: These sprays are directly applied to the manure surface to kill fly larvae.

Table- Examples of Larvicidal brands available for fly control

Group/class	Brand Name	Active ingredients	Manufacturer
Benzoylurea	Bi-larv	Diflubenzuron 25 % WP	Bayer Crop Sciences
	No Larve D	Diflubenzuron 25% WP	RR Veterinalry Healthcare
Benzoylurea + Pyrethroid	Dimilin	Diflubenzuron 20 % + Deltamethrin 2 % sc	Arysta Life sciences
Carbamate	Larvin	Thiodicarb 75% WP	Bayer Crop Sciences
Ether	Sumilarve	Pyriproxyfen 0.5 %	Sumitomo Chemicals Ltd
Herbal	Ecosol-L	Herbal	Nutricon Bio Sciences
	FLYNIL	Herbal	RR Veterinalry Healthcare
	Kil-n-nil	Herbal	SKN Biotech India (P) Ltd
	L - KILL	Herbal	RR Animal Health Care Ltd
	Larvend Gold	Herbal	Reddy Drugs Laboratories
	No Larve FA	Herbal	RR Veterinalry Healthcare
	Super Erazer	Herbal	Nutricon Bio Sciences
	BOLT ER	Essential oils	Anshuman Industries
Triazine	LBL	Cyromazine 2.0 %	RR Animal Health Care Ltd
	No Larve C	Cyromazine 2% + Kaolin	RR Veterinalry Healthcare

12.6.4.3 Adulticide sprays: These sprays are used to control adult flies inside and outside the poultry house. They can be residual sprays or quick knockdown sprays. Use them sparingly and only as a last resort to avoid resistance.

Table - Examples of some insecticides brands available for adult fly control

Group/class	Brand Name	Active ingredients	Manufacturer
Chloronicotinyl	Confidor	Emidacloprid 17.8 % w/w	Bayer Crop Sciences.
Herbal	Phytoman Mitee	Plant extract/enzymes	Anshuman Industries
	Liceout	Herbal	Nutricon Bio Sciences
	Rebuff	Herbal	SKN Biotech India (P) Ltd
Neonicotinoid	Thimix	Thiamethoxam 25% WG .	Indo Gulf Fertilizers
Organophosphate	Chlorguard	Chlorpyriphos 20 % ec	Gharda Chemicals Ltd
	DDFEX	Dichlorovos 75% EC	Safex chemical India Ltd
	Doom	Dichlorvos 76% EC	UPL limited
	NUVAN	Diclrovos 76% EC	Insecticides India Ltd
Organophosphate + Pyrethroid	IPL-505	Chlorpyriphos 50% + Cypermethrin 5% EC	India pesticide Ltd
Pyrethroid	Decis	Deltamethrin 2.8 % ec	Bayer Crop sciencses
	Disect	Bifenthrin 10 % wp	UPL limited
	Ektomin	Cypermethrin 10%w/v	ELANCO
	Raider	Cypermethrin 25% EC	India pesticide Ltd
	Responser	Beta-cyfluthrin 2.45% SC	Bayer Crop Sciences.
	Sentry	Lambda Cyhalothrin 10% WP	Rallis India Ltd
	STOP 10	Alphamethrin 10% EC	Biostadt India Ltd

12.6.4.4 Fly baits: Baits containing insecticides can be used as spot-on treatment and in traps to control adult flies. Place them where flies gather, but avoid the manure pit to protect beneficial parasites and predators. Fly paints, like Speedy paint, attract and kill flies upon contact. Apply them to clean surfaces in areas with heavy fly infestations.

Remember to always follow the instructions and guidelines provided by the manufacturer when using chemical control methods for fly control.

Table- Examples of some fly bait products

Group/class	Brand Name	Active ingredients	Manufacturer	Application method
Carbamate	FLYTROL	Propoxur 2.0 %	RR Animal Health Care Ltd	Bait
	Spot on Bait	Propoxur 2 %	RR Veternary Healthcare	Bait
Herbal	Fly way	Herbal	Globion	Bait
	FlyAct instant mix	Herbal	Nutricon Bio Sciences	Bait
	FlyAct Pellet	Herbal	Nutricon Bio Sciences	Bait
	FlyAct speedy paint	Herbal	Nutricon Bio Sciences	Paint
	ZAP	Herbal	SKN Biotech India (P) Ltd	Bait
Neonicotinoid	Quick Bayt	Imidacloprid 0.5% RB	Bayer Crop sciencses	Bait
Organic compound	Manik	Acetamiprid 20 % SP	Rallies India Ltd	Bait
	Support	Acetamiprid 20% SP	India pesticide Ltd	Bait

12.7 Rodent control.

Rodents pose significant risks as carriers of poultry diseases, contributing to re-contamination after cleaning and disinfection. They also facilitate disease spread within a farm. Beyond bio-security concerns, rodents damage buildings, wires, and feed, generating more waste and contamination than consumption. Signs of daytime rat sightings indicate high infestation, while nighttime rounds of sheds help assess rat population. Signs include burrows, pathways, claw marks, damaged wiring, curtains, and unusual flock behavior.

➢ ***Control Measures:***

- Construct Rat-Proof Structures: Design sheds and ancillary buildings to be rat-proof.
- Maintain Cleanliness: Eliminate waste, debris, spilled feed, and tall grass that can provide hiding spots.
- Seal Rat Holes: Close rat holes regularly.
- Perimeter Protection: Surround the house with a 1m (3 ft) crushed rock or concrete area to prevent burrowing.
- Secure Feed and Eggs: Store feed and eggs in rodent-proof locations.
- Traps: For small populations, employ rat or mouse traps. Allow rodents to get used to traps by placing non-set baited traps for a few days before setting them. Remove and dispose of trapped rodents daily.
- Glue Boards: Effective against mice. Check daily and dispose of captured rodents.

- Rodenticides: For larger infestations, use rodenticides cautiously. Rotate products if bait shyness occurs. Prebait with non-toxic bait for a week before using rodenticides. Place bait in high-activity areas, ensuring safety with bait stations.

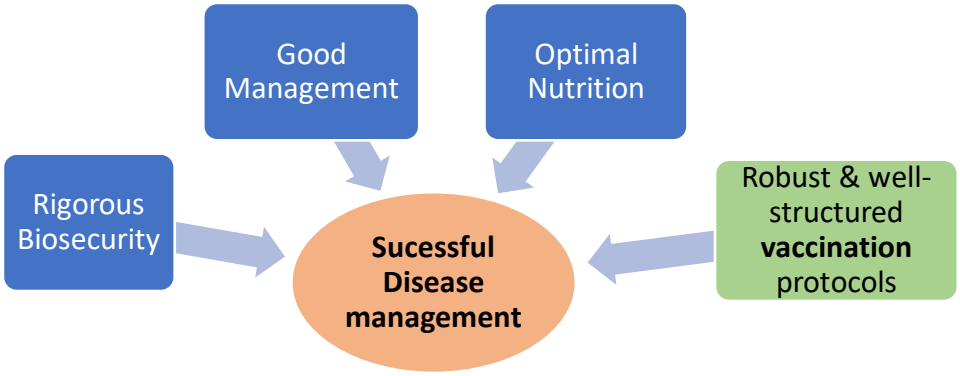
12.8 Control of wild birds.

- ☞ Protect sheds with chain link mesh to prevent wild/stray bird entry.
- ☞ Implement sparrow-proofing and regularly maintain it.
- ☞ Avoid feed spillage outside sheds, near silos, and feed areas.
- ☞ Refrain from planting trees that attract wild birds.
- ☞ Minimize green vegetation near sheds to reduce insect attraction.
- ☞ Regularly remove cobwebs and maintain cleanliness.
- ☞ Implement measures like radium strips, anti-bird nets, sound, and crow scares to deter wild birds.

Control measures against rodents and wild birds play a crucial role in safeguarding the poultry farm environment and maintaining bio-security standards.

12.9 Vaccination and Preventive Health Approach

To realize the full genetic potential of BV300 birds, it is imperative to minimize the influence of diseases within the flock.



The implementation of a thoughtfully designed vaccination and preventative health regimen, alongside stringent biosecurity measures, plays a pivotal role in mitigating the adverse impact of diseases on flock performance. These vaccination programs should be tailored to confer immunity against economically significant diseases.

Regular assessment of the vaccination schedule should be undertaken by the Poultry Disease Research Center (PDRC) or a expert veterinarian, based on disease prevalence both within your farm and the broader area.

- ☞ **Types of Vaccines**
  - Live attenuated virus vaccines
  - Inactivated (killed) virus vaccines
  - Recombinant virus vaccines
  - Inactivated (killed) Bacterial vaccines

☞ **Vaccination Methods**

Eye drop (intraocular)	Nasal instillation
Beak dipping	Subcutaneous injection
Intramuscular injection	Wing Web prick
Drinking water	Spray vaccination

☞ **Key Considerations During Vaccination**

- Maintain proper vaccine cold chain, storing it at temperatures between 2 to 8°C.
- Prevent freezing of inactivated vaccines and shield them from direct sunlight.
- Store Cell Associated Marek's Disease vaccine in Liquid Nitrogen (LN2) and follow recommended thawing procedures.
- **Vaccinate only healthy and unstressed flocks.**
- Opt for early morning vaccination during summer months.
- Adhere to recommended reconstitution methods and use supplied diluents.
- Record batch number, manufacturing date, expiry, and diluent details.
- For subcutaneous and intramuscular vaccination, employ a 20G ½ inch needle, change it frequently.
- **Avoid using water sanitizers on the day of water vaccination.**
- Temporarily withdraw water (1 to 2 hours) before water vaccination, depending on the season.
- Calculate required water quantity for vaccination to ensure consumption within two hours.
- Allow killed vaccine bottles to reach room temperature at least 6 hours prior to administration.
- Administer only the prescribed dose and route.

☞ Conduct regular serological monitoring throughout rearing and laying to establish antibody profiles. Poultry Diagnostic & Research Centre (PDRC) in Pune offers services to poultry farmers through their laboratory network throughout India.

☞ Follow recommended preventive medication protocols for mycoplasma.

12.10 Parasite Control

12.10.1 Internal Parasites

Internal parasites, including coccidia, Histomonas ("black head"), roundworms (Ascaridia), cecal worms (Heterakis), and tapeworms, can hinder flock health.

12.10.1.1 Coccidiosis

Coccidiosis, prevalent among laying hens, can exacerbate issues when combined with Clostridium perfringens, leading to necrotic enteritis.

☞ **Coccidiosis Management Strategies**

- Stringent biosecurity measures
- Maintenance of a clean and dry environment
- Effective litter management
- Appropriate anti-coccidial medication
- Early detection of infestation through monitoring
- Effective fly control programme

☞ **Anticoccidial Program for Commercial Layer**

✓ Change the anticoccidial drug every 3 months

✓ Rotate between drug classes

✓ Avoid prolonged use of a single drug

✓ Adapt to the challenge level by using more or less effective drugs accordingly. During period of high challenge - use the most effective drug.

☞ **Water medication for cocci prevention and treatment**

✓ Amprolium HCL (Kampro-H) is used for prevention and treatment of coccidiosis. For prevention , give 30g in 50litres of water for 5 to 7 days before shifting birds from brooding shed to growing shed or growing shed to laying shed. Can be given in mild infection(refer product manual for dosage).

✓ Baycox (Toltrazuril), ESB3 (Sulphaclozin), V-CLOZINE (sulphachloropyrazine) are some coccidiocidal drug used for treatment of cocciciosis. (Refer product manual for dosage and administration information).

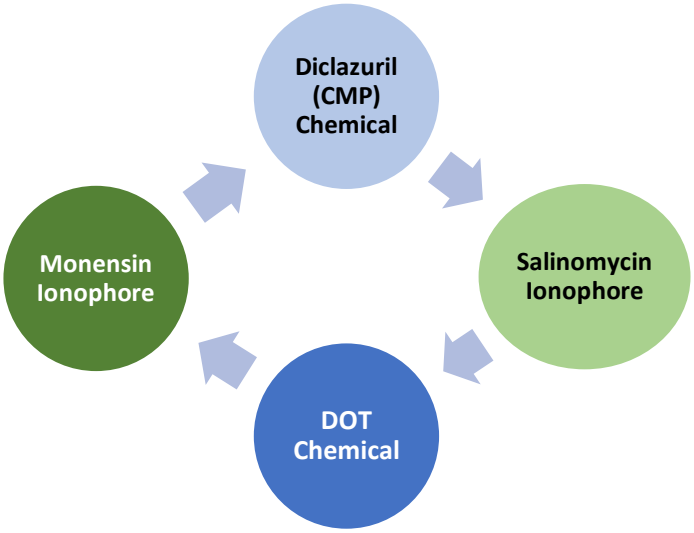


Figure (above): Example of Rotational Anticoccidial programme

12.10.1.2 Control of Tape and Round Worms

Follow the combination of cleaning, disinfection, biosecurity, and preventative or therapeutic deworming treatments as per the recommendations.

Deworming protocol during rearing period

Age	Medicine	Dose	Remark
15th, 16th & 17th day	Ventrimisole (Levamisole HCL 30%)	5 gram per 1000 birds	Immunostimulant
8th wk & 18th week	Albomar (Albendazole)	10 mg / kg body weight	One day

During laying period it is recommended to carryout deworming of the flock at every two month interval depending on the tape infestation in the flock.

Albomar (Albendazole), Piperazine Hexahydrate, Wormstop-M (mebendazole), Zodex (mebendazole) Cestonex-N (Niclosamide), are different anthelmintics products used for the deworming of birds.

12.10.2 External Parasites

- Mites, red mites, lice, bed bugs, mosquitoes, fleas and house flies are external parasites that can impact egg production and overall flock health.
- Preventive measures include biosecurity practices, preventing contact between infested and non-infested flocks, and direct application of acaricide products for control.
- Various products, such as pyrethroids, ivermectin, and mineral-based solutions, can be employed for effective mite control.

Overall, meticulous attention to disease prevention through bio-security measures, personnel hygiene, controlled vehicle movement, strict disinfection protocols, and well designed vaccination & preventive health programme significantly contributes to maintaining a disease-free and profitable poultry farm operation.

13. Egg – A Superfood

Chicken eggs have been considered as a wholesome and complete food because of its balanced nutrient profile suitable for human beings.

13.1 Nutritional value of an egg

Components of the egg make it an excellent source of high quality protein, vitamins and trace minerals. Hen eggs contain 73.6% water, 12.8% proteins and 11.8% lipid (source chiken egg, Panda AK et al 2011) Eggs are easily digested and absorbed to provide several essential nutrients.

Table-18 Nutrient composition of whole, raw chicken egg (50g)

Nutrients		Units	Per egg (50g)
Macro nutrients	Energy	Kcal	72
	Protein	g	6.28
	Total fat	g	4.76
	Carbohydrate	g	0.36
	Total sugar	g	0.18
	Cholesterol	mg	186
Minerals	Phosphorus	mg	116
	Potassium	mg	69
	Sodium	mg	71
	Calcium	mg	28
	Magnesium	mg	6
	Iron	mg	0.88
	Zinc	mg	0.64
	Copper	mg	0.036
	Manganese	mg	0.014
	Selenium	mcg	15.4
Vitamin	Vitamin A	IU	270
	Vitamin D3	mcg	1
	Vitamin E	mcg	520
	Vitamin K	mcg	0.2
	Thiamin	mcg	20
	Riboflavin	mcg	228
	Niacin	mcg	38
	Pyridoxine	mcg	130
	Pantothenic acid	mcg	766
	Biotin	mcg	10
	Vitamin B12	mcg	0.44
	Folic acid	mcg	37

Source: USDA National Nutrient database release 26, 2014

The egg protein is the best protein available for human consumption, with well balanced amino acid profile, having the highest biological value, protein efficiency ratio, net protein utilization and percent digestibility as compared to other food stuffs.

Table 19: Comparative Nutritive values of egg and other food stuffs

Food stuff	Biological Value	PER	NPU	Chemical Score	% Digestibility
Egg	96	4.5	93	100	97
Milk	85	3.0	81	65	94
Meat	80	2.8	76	70	82
Chicken	82	2.9	78	71	85
Fish	85	3.0	72	70	85
Soybean	64	2.0	54	57	73
Chickpea	58	1.7	47	44	74
Peas	56	1.6	45	42	72
Peanuts	54	1.7	45	44	78
Rice	64	2.0	57	60	90
Wheat	58	1.7	47	42	90
Maize	45	1.3	34	35	85
Ragi	58	1.6	44	43	84
Bajra	62	1.8	52	52	88

PER=Protein Effiicency Ratio, NPU= Net Protein Utilization

Source : (Panda AK et al ,2011 and Narhari, 2005)

13.2 Healthy eating guidelines for children

☞ **When to introduce eggs?**

In 2001, the World Health Organization (WHO) recommended exclusive breast feeding until 6 months (26 weeks) of age. At about 6 months babies are ready to move on to a complementary food containing eggs (WHO, 2002).

☞ **How often and how much to give?**

The WHO and Pan American Health Organization (PAHO) recommend that eggs should be eaten daily or as often as possible because they are rich source of many nutrients such as iron and zinc (WHO,2002).

☞ **Cooking**

Eggs given to babies or toddlers should be cooked until both yolk and the white are solid in any fashion; boiled, scrambled, poached or in an omelette.

Properly cooking eggs to a temperature of 63 ^{o}C for 3 minutes will destroy *Salmonella enterica* present in an egg. Recipes containing eggs mixed with other foods should be cooked to an internal temperature of 160^{o}F (71^{o}C).

☞ **Storage**

Eggs should be kept refrigerated. Eggs should be brought to room temperature before cooking. Cooked egg dishes should be eaten as soon as possible after cooking and, if not for immediate use should be stored in the refrigerator.

13.3 Myths and Facts about an egg

❖ **Egg Consumption and Heat production**

Myth: Egg consumption leads to excess heat production in the body.
Fact: This assumption is not true. In fact an egg contributes only 84kcal energy which is less than 4% of the recommended daily allowance of energy for human being. Interestingly, the energy value of one egg is about one forth of the 100g of rice or wheat.

(Knowledge engine of chicken egg, Panda et al 2011)

❖ **Egg consumption and heart problem**

Myth: Egg is rich in cholesterol, therefore, egg consumption leads to heart problems.
Fact: This belief is not correct. Egg is fairly rich in cholesterol. The average large egg contains around 200mg of cholesterol. The dietary cholesterol concentration has little effect on its concentration in body. Complexity and totality of food habits, other non-dietary habits and heredity are primarily responsible for cholesterol concentration in the serum. Higher concentration of saturated fatty acids (SFA) compared to unsaturated fatty acids (USFA), would increase production of cholesterol in the body. Chicken egg contains higher concentration of USFA to SFA (0.59-0.61, critical level is >0.3), which is known to suppress endogenous production of cholesterol in people consuming eggs. Therefore egg consumption does not lead to heart problem.

(Knowledge engine of chicken egg, Panda et al 2011)

❖ **Native Vs Farm eggs**

Myth: Eggs from native hen are higher in nutritive value than farm eggs.
Fact: It is not true. Some times yolk of the egg produced by native hen is dark yellow in color which is influenced by xanthophyll content of diet. It has no nutritive value.

❖ **Blood and meat spot in eggs**

Myth: Eggs with blood and meat spot are unhealthy and fertile.
Fact: Blood spots are caused by rupture of blood vessels during formation of eggs in oviduct and meat spots are due to incorporation of a part of tissue of oviduct. Such eggs are not fertile as table eggs are produced from intensive rearing. Part of egg with blood or meat spot may be removed with the help of spoon or knife while cooking. These eggs are fit for consumption.

❖ **Double or multiple yolk eggs**

Myth: Double yolk eggs are not good for health.
Fact: Usually, hen's ovary releases only one yolk at a time under influence of reproductive hormone. However some times two or more yolks may be released at the same time due to over stimulation of ovary by higher level of reproductive hormones. Such eggs have similar nutritive value per unit of egg mass and good for consumption.

Annexure 1: Sample formulation with Maize + Soya (without enzymes)

S No	Ingredient	Rearing				Laying			
		Chicks	Grower	Developer	Prelay	Phase I	Phase II	Phase III	Phase IV
	Feed intake g/b/d					100	110	110	110
1	Maize	597	615	552	553	562	571	551	533
2	Deoiled Rice bran	20	60	210	145	65	125	166	205
3	Soybean crude oil	12	5	5	10	10	5	5	5
4	Deoiled Soybean Meal 46%	325	275	190	215	240	183	159	133
5	Marble grit			8.0	25.0	65.0	65.0	75.0	85.0
6	Limestone powder	12.50	14.00	8.00	24.00	31.00	28.00	24.50	20.50
7	Di calcium phosphate	18.50	17.50	15.50	16.00	15.00	12.00	9.50	8.00
8	L- Lysine	0.75	0.80	0.00	0.00	0.00	0.20	0.30	0.50
9	DL- Methionine	2.40	2.10	1.50	1.90	2.30	1.65	1.35	1.20
10	L-Threonine	0.45	0.35	0.00	0.05	0.15	0.05	0.05	0.05
11	Salt	2.00	1.90	2.20	2.20	2.20	1.90	1.80	1.80
12	Sodium bicarbonate	3.00	2.50	2.00	2.00	2.20	1.80	2.00	2.00
13	Choline Chloride (60%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
14	Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
15	Trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Liver tonic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
17	Toxin binder	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Acidifier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Coccidiostat	0.50	0.50	0.50					
	Total	1000	1000	1000	1000	1000	1000	1000	1000

Annexure 2: Sample formulation with Maize + Soya (with enzymes)

S No	Ingredient	Rearing				Laying			
		Chicks	Grower	Developer	Prelay	Phase I	Phase II	Phase III	Phase IV
	Feed intake g/b/d					100	110	110	110
1	Maize	560	581	518	518	529	537	517	498
2	Deoiled Rice bran	80	120	270	205	120	180	220	260
3	Soybean crude oil	12	5	5	10	10	5	5	5
4	Deoiled Soybean Meal 46%	305	253	168	194	220	165	142	115
5	Marble grit			8	25	65	65	75	85
6	Limestone powder	18.5	19.0	13.0	29.0	37.0	34.0	30.5	25.5
7	Di calcium phosphate	10.0	9.0	6.5	7.0	6.0	3.0	0.3	0.0
8	L- Lysine	0.65	0.70	0.00	0.00	0.00	0.10	0.20	0.40
9	DL- Methionine	2.20	1.90	1.40	1.75	2.15	1.50	1.20	1.05
10	L-Threonine	0.30	0.20	0.00	0.00	0.05	0.00	0.00	0.00
11	Salt	2.00	1.90	2.20	2.20	2.20	1.90	1.80	1.80
12	Sodium bi carbonate	3.00	2.50	2.00	2.00	2.20	1.80	2.00	2.00
13	Choline Chloride (60%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
14	Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
15	Trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	Liver tonic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
17	Toxin binder	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Acidifier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Coccidiostat	0.50	0.50	0.50					
20	Xylanase 2000	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
21	Phytase 5000	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.090
22	Protease	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
	Total	1000	1000	1000	1000	1000	1000	1000	1000

Annexure 3: Sample formulations with alternate ingredients

Alternate ingredients: **Bajra** and **Rapeseed meal**

S No	Ingredient	Rearing				Laying			
		Chicks	Grower	Developer	Prelay	Phase I	Phase II	Phase III	Phase IV
	Feed intake g/b/d					100	110	110	110
1	Maize	325	356	290	281	289	310	290	270
2	Bajra	250	250	250	250	250	250	250	250
3	Deoiled Rice bran	75	75	230	200	120	140	183	220
4	Soybean crude oil	11	5	5	10	10	5	5	5
5	Deoiled Soybean Meal 46%	295	223	135	185	210	131	105	83
6	Deoiled rapeseed meal 36%		50	50			50	50	50
7	Marble grit			8.0	25.0	65.0	65.0	75.0	85.0
8	Limestone powder	18.5	19.0	13.0	29.0	37.0	34.0	30.5	25.5
9	Di calcium phosphate	10.5	9.0	7.0	7.5	6.5	3.5	0.5	0.0
10	L- Lysine	0.75	0.80	0.10	0.00	0.00	0.25	0.40	0.50
11	DL- Methionine	2.20	1.70	1.15	1.75	2.15	1.30	1.00	0.80
12	L-Threonine	0.40	0.15	0.00	0.00	0.05	0.00	0.00	0.00
13	Salt	2.10	1.90	2.20	2.20	2.20	1.90	1.80	1.80
14	Sodium bi carbonate	3.00	2.50	2.00	2.20	2.20	2.00	2.00	2.00
15	Choline Chloride (60%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
16	Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
17	Trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Liver tonic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
19	Toxin binder	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Acidifier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Coccidiostat	0.50	0.50	0.50					
22	Xylanase 2000	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
23	Phytase 5000	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.090
24	Protease	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
	Total	1000	1000	1000	1000	1000	1000	1000	1000

Annexure 4: Sample formulations with alternate ingredients

Alternate ingredients: Rice and Rapeseed meal

S No	Ingredient	Rearing				Laying			
		Chicks	Grower	Developer	Prelay	Phase I	Phase II	Phase III	Phase IV
	Feed intake g/b/d					100	110	110	110
1	Maize	296	328	265	256	266	282	267	247
2	Rice grade- I	250	250	250	250	250	250	250	250
3	Deoiled Rice bran	98	98	250	223	138	163	200	238
4	Soybean crude oil	12	5	5	10	10	5	5	5
5	Deoiled Soybean Meal 46%	300	228	140	188	215	137	111	89
6	Deoiled rapeseed meal 36%		50	50			50	50	50
7	Marble grit			8	25	65	65	75	85
8	Limestone powder	18.5	19.0	13.0	29.0	37.0	34.0	30.5	25.5
9	Di calcium phosphate	10.5	9.0	6.5	7.5	6.5	3.0	0.5	0.0
10	L- Lysine	0.65	0.70	0.00	0.00	0.00	0.10	0.30	0.40
11	DL- Methionine	2.20	1.70	1.15	1.75	2.15	1.25	1.00	0.80
12	L-Threonine	0.40	0.20	0.00	0.05	0.10	0.00	0.00	0.00
13	Salt	2.30	2.00	2.30	2.30	2.30	2.00	1.90	1.90
14	Sodium bi carbonate	3.00	2.70	2.20	2.20	2.40	2.00	2.20	2.20
15	Choline Chloride (60%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
16	Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
17	Trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	Liver tonic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
19	Toxin binder	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Acidifier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
21	Coccidiostat	0.50	0.50	0.50					
22	Xylanase 2000	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
23	Phytase 5000	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.090
24	Protease	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
	Total	1000	1000	1000	1000	1000	1000	1000	1000

Annexure 5: Sample formulations with alternate ingredients

Alternate ingredient: DDGS Rice

S No	Ingredient	Rearing				Laying			
		Chicks	Grower	Developer	Prelay	Phase I	Phase II	Phase III	Phase IV
	Feed intake g/b/d					100	110	110	110
1	Maize	560	573	512	518	529	531	511	493
2	Deoiled Rice bran	80	120	270	205	120	180	223	260
3	Soybean crude oil	12	5	5	10	10	5	5	5
4	Deoiled Soybean Meal 46%	305	230	143	194	220	140	114	90
5	DDGS Rice		30	30			30	30	30
6	Marble grit			8.0	25.0	65.0	65.0	75.0	85.0
7	Limestone powder	18.5	19.0	13.0	29.0	37.0	34.0	30.5	25.5
8	Di calcium phosphate	10.00	9.00	7.00	7.00	6.00	3.50	0.50	0.00
9	L- Lysine	0.65	1.10	0.40	0.00	0.00	0.55	0.70	0.80
10	DL- Methionine	2.20	1.70	1.15	1.75	2.15	1.30	1.00	0.80
11	L-Threonine	0.30	0.20	0.00	0.00	0.05	0.00	0.00	0.00
12	Salt	2.00	1.90	2.20	2.20	2.20	1.90	1.80	1.80
13	Sodium bi carbonate	3.00	2.50	2.00	2.00	2.20	1.80	2.00	2.00
14	Choline Chloride (60%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
15	Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
16	Trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Liver tonic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
18	Toxin binder	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Acidifier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Coccidiostat	0.50	0.50	0.50					
21	Xylanase 2000	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
22	Phytase 5000	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.090
23	Protease	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
	Total	1000	1000	1000	1000	1000	1000	1000	1000

Annexure 6: Sample formulations with alternate ingredients

Alternate ingredients: Rapeseed meal

S No	Ingredient	Rearing				Laying			
		Chicks	Grower	Developer	Prelay	Phase I	Phase II	Phase III	Phase IV
	Feed intake g/b/d					100	110	110	110
1	Maize	560	592	528	518	529	547	528	509
2	Deoiled Rice bran	80	80	230	205	120	140	183	220
3	Soybean crude oil	12	5	5	10	10	5	5	5
4	Deoiled Soybean Meal 46%	305	233	148	194	220	145	118	95
5	Deoiled rapeseed meal 36%		50	50			50	50	50
6	Marble grit			8.0	25.0	65.0	65.0	75.0	85.0
7	Limestone powder	18.5	19.0	13.0	29.0	37.0	34.0	30.5	25.5
8	Di calcium phosphate	10.0	8.5	6.5	7.0	6.0	2.5	0.0	0.0
9	L- Lysine	0.65	0.70	0.00	0.00	0.00	0.10	0.30	0.40
10	DL- Methionine	2.20	1.70	1.15	1.75	2.15	1.30	1.00	0.80
11	L-Threonine	0.30	0.10	0.00	0.00	0.05	0.00	0.00	0.00
12	Salt	2.00	1.90	2.20	2.20	2.20	1.90	1.80	1.80
13	Sodium bi carbonate	3.00	2.50	2.00	2.00	2.20	1.80	2.00	2.00
14	Choline Chloride (60%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
15	Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
16	Trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Liver tonic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
18	Toxin binder	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Acidifier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Coccidiostat	0.50	0.50	0.50					
21	Xylanase 2000	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
22	Phytase 5000	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.085
23	Protease	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
	Total	1000	1000	1000	1000	1000	1000	1000	1000

Annexure 7: Sample formulations with alternate ingredients

Alternate ingredients: Sunflower meal

S No	Ingredient	Rearing				Laying			
		Chicks	Grower	Developer	Prelay	Phase I	Phase II	Phase III	Phase IV
	Feed intake g/b/d					100	110	110	110
1	Maize	575	594	530	530	544	551	534	513
2	Deoiled Rice bran	25	70	220	155	65	130	170	210
3	Soybean crude oil	12	5	5	10	10	5	5	5
4	Deoiled Soybean Meal 46%	295	240	155	183	210	151	124	100
5	Deoiled Sunflower meal 28%	50	50	50	50	50	50	50	50
6	Marble grit			8	25	65	65	75	85
7	Limestone powder	18.5	19.0	13.0	29.0	37.0	34.0	30.5	25.5
8	Di calcium phosphate	9.5	8.5	6.5	6.5	6.0	2.5	0.3	0.0
9	L- Lysine	0.85	1.00	0.25	0.25	0.20	0.40	0.60	0.70
10	DL- Methionine	2.10	1.85	1.30	1.70	2.05	1.40	1.15	0.95
11	L-Threonine	0.30	0.20						
12	Salt	2.10	1.90	2.20	2.20	2.20	1.90	1.80	1.80
13	Sodium bi carbonate	3.00	2.50	2.00	2.00	2.20	1.80	2.00	2.00
14	Choline Chloride (60%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
15	Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
16	Trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Liver tonic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
18	Toxin binder	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Acidifier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Coccidiostat	0.50	0.50	0.50					
21	Xylanase 2000	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
22	Phytase 5000	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.085
23	Protease	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
	Total	1000	1000	1000	1000	1000	1000	1000	1000

Annexure 8: Sample formulations with alternate ingredients

Alternate ingredients: Groundnut cake

S No	Ingredient	Rearing				Laying			
		Chicks	Grower	Developer	Prelay	Phase I	Phase II	Phase III	Phase IV
	Feed intake g/b/d					100	110	110	110
1	Maize	560	578	510	518	529	532	512	493
2	Deoiled Rice bran	80	100	255	205	120	165	205	240
3	Soybean crude oil	12	5	5	10	10	5	5	5
4	Deoiled Soybean Meal 46%	305	225	140	194	220	134	110	90
5	Deoiled Groundnut meal 40 %		50.0	50.0			50.0	50.0	50.0
6	Marble grit			8.0	25.0	65.0	65.0	75.0	85.0
7	Limestone powder	18.5	19.0	13.0	29.0	37.0	34.0	30.5	25.5
8	Di calcium phosphate	10.0	9.0	6.5	7.0	6.0	3.0	0.5	0.0
9	L- Lysine	0.65	1.10	0.30	0.00	0.00	0.50	0.60	0.70
10	DL- Methionine	2.20	1.95	1.35	1.75	2.15	1.50	1.20	1.05
11	L-Threonine	0.30	0.30			0.05			
12	Salt	2.00	1.90	2.20	2.20	2.20	1.90	1.80	1.80
13	Sodium bi carbonate	3.00	2.50	2.00	2.00	2.20	1.80	2.00	2.00
14	Choline Chloride (60%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
15	Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
16	Trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Liver tonic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
18	Toxin binder	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Acidifier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Coccidiostat	0.50	0.50	0.50					
21	Xylanase 2000	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
22	Phytase 5000	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.090
23	Protease	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
	Total	1000	1000	1000	1000	1000	1000	1000	1000

Annexure 9: Sample formulations with alternate ingredients

Alternate ingredients: Cottonseed meal

S No	Ingredient	Rearing				Laying			
		Chicks	Grower	Developer	Prelay	Phase I	Phase II	Phase III	Phase IV
	Feed intake g/b/d					100	110	110	110
1	Maize	560	583	520	518	529	540	523	503
2	Deoiled Rice bran	80	95	245	205	120	160	195	235
3	Soybean crude oil	12	5	5	10	10	5	5	5
4	Deoiled Soybean Meal 46%	305	250	165	194	220	157	135	110
5	Cottonseed meal 35%		25	25			25	25	25
6	Marble grit			8.0	25.0	65.0	65.0	75.0	85.0
7	Limestone powder	18.5	19.5	13.0	29.0	37.0	34.0	30.5	25.5
8	Di calcium phosphate	10.0	8.5	6.5	7.0	6.0	2.5	0.3	0.0
9	L- Lysine	0.65	0.70	0.00	0.00	0.00	0.20	0.30	0.40
10	DL- Methionine	2.20	1.90	1.35	1.75	2.15	1.45	1.15	0.95
11	L-Threonine	0.30	0.20	0.00	0.00	0.05	0.00	0.00	0.00
12	Salt	2.00	1.90	2.20	2.20	2.20	1.90	1.80	1.80
13	Sodium bi carbonate	3.00	2.50	2.00	2.00	2.20	1.80	2.00	2.00
14	Choline Chloride (60%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
15	Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
16	Trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Liver tonic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
18	Toxin binder	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Acidifier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Coccidiostat	0.50	0.50	0.50					
21	Xylanase 2000	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
22	Phytase 5000	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.085
23	Protease	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
	Total	1000	1000	1000	1000	1000	1000	1000	1000

Annexure 10: Sample formulations with alternate ingredients

Alternate ingredients: Sesame meal

S No	Ingredient	Rearing				Laying			
		Chicks	Grower	Developer	Prelay	Phase I	Phase II	Phase III	Phase IV
	Feed intake g/b/d					100	110	110	110
1	Maize	563	584	521	521	532	544	524	506
2	Deoiled Rice bran	58	95	248	183	95	140	180	220
3	Soybean crude oil	12	5	5	10	10	5	5	5
4	Deoiled Soybean Meal 46%	300	250	163	190	218	148	124	98
5	Sesame meal	25	25	25	25	25	50	50	50
6	Marble grit			8	25	65	65	75	85
7	Limestone powder	18.5	19.0	13.0	28.0	37.0	34.0	30.5	25.5
8	Di calcium phosphate	9.5	8.5	6.5	6.5	6.0	3.0	0.3	0.0
9	L- Lysine	0.75	0.80	0.10	0.10	0.00	0.50	0.60	0.75
10	DL- Methionine	2.00	1.75	1.20	1.60	1.95	1.20	0.90	0.70
11	L-Threonine	0.30	0.15	0.00	0.00	0.00	0.00	0.00	0.00
12	Salt	2.00	1.90	2.20	2.20	2.20	1.90	1.80	1.80
13	Sodium bi carbonate	3.00	2.50	2.00	2.00	2.20	2.00	2.00	2.00
14	Choline Chloride (60%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
15	Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
16	Trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Liver tonic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
18	Toxin binder	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Acidifier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Coccidiostat	0.50	0.50	0.50					
21	Xylanase 2000	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
22	Phytase 5000	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.090
23	Protease	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
	Total	1000	1000	1000	1000	1000	1000	1000	1000

Annexure 11: Sample formulations with alternate ingredients

Alternate ingredient: Fish Meal

S No	Ingredient	Rearing				Laying			
		Chicks	Grower	Developer	Prelay	Phase I	Phase II	Phase III	Phase IV
	Feed intake g/b/d					100	110	110	110
1	Maize	545	567	508	507	517	523	502	485
2	Deoiled Rice bran	100	140	295	230	145	205	245	280
3	Soybean crude oil	12	5	5	10	10	5	5	5
4	Deoiled Soybean Meal 46%	275	222	128	155	182	128	105	83
5	Fish meal (45%)	30	30	30	30	30	30	30	30
6	Marble grit	0.0	0.0	8.0	25.0	65.0	65.0	75.0	85.0
7	Limestone powder	18.5	19.0	13.0	29.0	37.0	33.5	27.5	22.5
8	Di calcium phosphate	5.5	4.5	2.5	3.0	2.0	0.0	0.0	0.0
9	L- Lysine	0.45	0.50	0.00	0.00	0.00	0.00	0.10	0.20
10	DL- Methionine	2.10	1.80	1.30	1.75	2.15	1.40	1.10	0.95
11	L-Threonine	0.30	0.15	0.00	0.00	0.05	0.00	0.00	0.00
12	Salt	1.30	1.20	1.50	1.50	1.50	1.20	1.10	1.10
13	Sodium bi carbonate	3.00	2.50	2.00	2.00	2.20	1.80	2.00	2.00
14	Choline Chloride (60%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
15	Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
16	Trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Liver tonic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
18	Toxin binder	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Acidifier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Coccidiostat	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00
21	Xylanase 2000	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
22	Phytase 5000	0.100	0.100	0.100	0.100	0.100	0.090	0.060	0.040
23	Protease	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
	Total	1000	1000	1000	1000	1000	1000	1000	1000

Annexure 12: Sample formulations with alternate ingredients

Alternate ingredient: Meat and Bone meal (MBM)

S No	Ingredient	Rearing				Laying			
		Chicks	Grower	Developer	Prelay	Phase I	Phase II	Phase III	Phase IV
	Feed intake g/b/d					100	110	110	110
1	Maize	549	568	507	507	518	528	507	489
2	Deoiled Rice bran	75	120	275	210	123	175	215	250
3	Soybean crude oil	12	5	5	10	10	5	5	5
4	Deoiled Soybean Meal 46%	300	245	150	178	205	153	130	108
5	Meat and bone meal (45%)	30	30	30	30	30	30	30	30
6	Marble grit	0.0	0.0	8.0	25.0	65.0	65.0	75.0	85.0
7	Limestone powder	18.5	19.0	13.0	29.0	37.0	33.5	27.5	22.5
8	Di calcium phosphate	1.5							
9	L- Lysine	0.45	0.50	0.00	0.00	0.00	0.00	0.10	0.20
10	DL- Methionine	2.20	1.95	1.45	1.85	2.25	1.55	1.25	1.05
11	L-Threonine	0.30	0.15	0.00	0.00	0.05	0.00	0.00	0.00
12	Salt	1.80	1.65	1.80	1.90	1.90	1.60	1.50	1.50
13	Sodium bi carbonate	3.00	2.20	2.00	2.00	2.00	1.80	2.00	2.00
14	Choline Chloride (60%)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
15	Vitamin premix	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
16	Trace mineral premix	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
17	Liver tonic	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
18	Toxin binder	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
19	Acidifier	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	Coccidiostat	0.50	0.50	0.50					
21	Xylanase 2000	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
22	Phytase 5000	0.100	0.100	0.080	0.080	0.075	0.040	0.010	0.000
23	Protease	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
	Total	1000	1000	1000	1000	1000	1000	1000	1000

Notes

Notes

The Department of Scientific and Industrial Research, Ministry of Science and Technology presented "National Award For R&D Efforts In Industry" to VRB in 1994.

Dr. G. L. Jain elected to the International Poultry Hall of Fame by World's Poultry Science Association. The prestigious award was conferred upon Dr. Jain at the XXIV World's Poultry Congress on 8th August,2012 at Salvador Brazil

ZONAL SALES OFFICES

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