BV380

Brown Egg Layer

Commercial Stock Management Guide

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APPENDICES

1. INTRODUCTION

BV380 is chocolate brown feathered bird and is colour sexable variety. Egg shell colour is uniform brown.

BV380 is the result of over three decades of R&D at Venkateshwara Research and Breeding Farm (VRB), Pune, India. The birds are evaluated for selection in conditions similar to average Poultry Farm conditions of India with respect to feeding and husbandry practices.

This guide contains the basic principles which are necessary for obtaining optimum production from BV380 Layer stock.

It is not a warranty or guarantee of performance. Environmental conditions beyond your control may affect the outcome of your management program. How well you anticipate and react to these conditions will determine the results for any particular flock.

2. LOCATION AND HOUSING TYPES

Proper site selection, strict bio-security, farm isolation and scientific cleaning and disinfection programme is necessary to prevent entry of pathogens as well as spread of diseases in the farm resulting in a profitable business unit.

2.1 LOCATION AND SITE SELECTION

Farm should be located as far as possible away from other poultry operations and human populations. Proper road access, ample good quality water supply, good air movement, moderate climate and electricity availability should also be considered while selecting a farm location. Each phase of production should be treated as a separate unit, according to the principle of "all in – all out": this means it should be only one age group in the farm and only one origin. Brooder and grower houses should be completely isolated from layer houses.

2.2 HOUSING TYPES AND FARM LAY OUT

Poultry houses are to be designed as per the climatic conditions of a particular region. Open sided housing systems are recommended in most of the areas. However, considering the climatic severity in summer season, appropriate measures needs to be taken to achieve optimum production performance. It is always advisable to have "all in – all out" system. In India, it is recommended to have poultry houses in East-West direction to avoid direct exposure to sun light. At the time of construction, provide overhang roof of 5 feet and 2 feet rat proofing platform on all the sides. Windows may be provided in gable walls for better ventilation. Chain link mesh of ¾ sq inch should be provided length wise on both sides of the house. Open ridge at the roof is better to facilitate hot air movement during the summer season. Sparrow proofing at eves of the walls and at open ridge at the roof is necessary.

Irrespective of housing types, shed construction should be such that it must be easily and thoroughly cleaned and disinfected between flocks.

There should be only one central entrance to the farm. Keep minimum 100 feet distance between two sheds. Farm should be properly fenced to restrict entry of dogs and other animals in the farm. Isolate residential area from the farm. Farm area should be fenced separately to designate as clean area.

3. HYGIENE, SANITATION AND BIO-SECURITY

A good bio-security program identifies and controls the most likely ways a disease could enter the farm.

3.1 Personnel Hygiene and Movement

- Visitors to the farm should be limited to those who are essential for its operation. All visitors, staff and workers should enter the farm at a central location. Visitors should use a logbook to document their visits. Anyone having been on another poultry facility within 48 hours should not be permitted access. People from other poultry farms must be strictly banned.
- Workers on the farm must not keep poultry or pet birds at home or come into contact with other poultry. Dogs and cats should be kept out of the farm.
- Dedicated workers for culls with dress code. After finishing culls transportation, do not allow culls workers in the farm.
- Regular health check-up of farm personnel.
- Do not allow sales representative to visit on the farm site.
- Vehicle drivers should never be allowed to enter the houses.
- Clean clothing and foot wear should be provided for every one working in the farm or visiting the farm.
- Ideally, workers should be limited to a single house. Supervisor movement between sheds should be only after proper bio-security care.
- If possible, avoid using outside team or equipment for vaccination, transfer and beak trimming.
- Always visit from younger to older flocks and from healthy to sick flocks. After visiting a sick flock, no other flocks should be visited.

3.2 Vehicle Movement

- Keep dedicated vehicle for inside the farm. Inside vehicle should be in side and outside vehicle should be out side the farm. Do not allow any out side vehicle to be entered in the farm. Feed, store material and chick boxes should be loaded into inside vehicle at main gate only.
- Liquidation of flock is a time when disease can be introduced. Never allow culls vehicle or chick delivery van to the farm site. Keep such vehicles at distance place of at least 2 km from farm. Ensure that these vehicles should be washed properly at washing center before reaching to site for taking delivery of culls or eggs. Farm vehicle should be used to deliver eggs or culls to that particular site. Take care that persons from culls vehicle or delivery boy should not enter in farm vehicle. Keep safe distance between two vehicles at loading area. Spray farm vehicles and tyres before leaving the loading area and at the farm entry.
- Maintain vehicle register to control unnecessary vehicle movement.

3.3 Disinfection Room

Provide a close room near main gate for disinfection of any material coming from out side. Unload material in the room, fumigate with Formalin and Potassium Permanganate: Use 40 ml formalin (40%) and 20g Potassium Permanganate (KmnO4) for area of 1 cu meter (0.6g KmnO4 + 1.2ml formalin for 1 cu ft). Add formalin to potassium permanganate in porcelain bowl kept in side the room. (Caution- Never add potassium permanganate to formalin). Fumigate for 20 minutes and then ventilate the room through exhaust fan to allow formaldehyde gas to escape.

3.4 Vehicle Disinfection

Provide a vehicle wash at main gate entrance. If any vehicle has to enter the farm premises or residential area located inside the farm premise should be thoroughly washed to remove dust and

organic material and then sprayed with disinfectant. Washing of vehicle tyre with high pressure washing machine is always better. If vehicle dip is used than change disinfectant water daily.

3.5 Change Room

- Do not allow any employee to change their dress or uniform at their house even though they are residing inside the campus.
- Provide separate change room facilities near farm entrance for staff, gents and ladies workers. It should have uninterrupted water supply for bath with hot water provision.
- There should be a central narrow entrance for all change room compartments. All employee should be fogged with fine disinfectant solution mist before entry to change room. Provide a foot dip just before change room entrance.
- Change room should have dirty and clean area. Provide individual lockers to every employee in both dirty and clean area. Employee should remove their foot wares and civil clothes in dirty side and keep in lockers provided. After taking proper bath, wear clean uniform/dress and foot wares (slipper or chappals) provided in clean area.
- Used uniform/dress should be washed daily in industrial washing machine with hot water.
- Once all employees entered the farm, change room should be washed thoroughly and sprayed with disinfectant solution. Fumigate change room at weekly intervals.
- DO NOT GO OUT OF FARM...Unless you are willing to take bath again..

3.6 Hand Wash and Foot Dip

- Hand wash and foot dip should be provided at entrance of every shed. Use foot dip while entry and exit from shed. Maintain it clean and with disinfectant solution always.
- Use disinfectant like safe guard @ 4ml/lit for foot and hand wash.
- Change disinfectant solution every day.
- Each shed should be provided with required foot wares for inside use only. Employee should remove their foot ware outside the shed and wear inside foot ware in the shed.

3.7 Shed Cleaning and Disinfection

As soon as the flock has been transferred or liquidated, the house and the equipment should be thoroughly cleaned and disinfected. Cleaning and disinfection of the house between flocks serves to reduce the infection pressure for a new incoming flock.

The total shed cleaning and disinfection programme can be grossly divided in three main steps as follows:

A. Dry Cleaning
   a. Before cleaning
   b. Cleaning
B. Washing (Wet Cleaning)
C. Terminal Disinfection

3.7.1 <u>DRY CLEANING</u>

3.7.1.1 BEFORE CLEANING

- Educate Personnel: Make sure that all personnel involved in the shed cleaning and disinfection process know the aim and importance of the same.
- After Liquidation of the flock, spray insecticide (*Malathion* @ 6 ml / lit) inside and outside of the shed.
- Spray *Formalin* 6% on the litter material or manure.
- Remove unused feed from shed, hoppers and feeder.
- Remove scrap material from shed.
- Flame gun burning should be done inside and outside of the shed and cages.
- Water tank and nipple lines are drain out completely and allowed to dry.

- Remove scrap material from shed.
- Take out all movable equipments (like chick guard, drinkers, feeders, nylon rope etc.) and allow to sundry.

3.7.1.2 CLEANING:

- Close the curtains and broom down heavy accumulation of dust, spider webs, feathers and other debris from angles, perlin, roof, side wall and chain link.
- Spray suitable insecticide to control insects like black beetles.
- Remove litter/ manure from shed: It should be scrapped down well, fill in the gunny bags or load it in the vehicle, cover the vehicle with the tarpaulin to avoid spillage during carriage. Spray some disinfectant over the vehicle and transport it away from facility.
- Sweeping: Sweeping the shed is also important aspect of dry cleaning to remove dust (organic matter).
- Complete major repairing work and meson work in the shed.
- Switch-off Electric connections.

3.7.2 WASHING (WET CLEANING):

- Flame gun burning (heat disinfection) inside and outside area of the shed.
- Wash outside of House from top to bottom. It is mandatory to wash the extended portion of the roof outside the shed.
- Wash the shed roof, chain link, cages and floor with hot water and suitable detergent (UBC @ 1lit. for 500 lit. of water) with help of high pressure gun. Wash the shed first from ceiling, side wall, curtain and lastly floor.
- Soak the shed floor over night with caustic soda @ 1kg / 200 litre of water for 1000 sq.ft. (for pakka floor), 2kg / 200 lit. water for 1000 sq.ft. (for soily floor).
- Water tank and nipple line cleaning: Calculate water holding capacity of the water lines of the shed; take that quantity of water in the internal tank. Then add Aquamax (50ml/liter). Allow the prepared solution to flow in the lines. For removing bio-film this solution must be left in the pipe line for 24 hours. Next day flush the water lines with plain clean water and allow it to remain dry till the new once arrive.
- Carry out repairing work of cages, feeders, Channels, chain link etc.
- Give white wash of lime and pesticide to the under roof, sidewalls and pillars. Add protekt (5ml/lit) in lime solution.
- Painting of cages, feeders, stands, angles, doors, windows and chain link.
- Checking of all electric connection and tube lights.

3.7.3 TERMINAL DISINFECTION

- Airtight the shed with HDPE/ sir Pauline curtains for terminal disinfection.
- Take necessary equipment/items from store to shed before terminal disinfection.
- Spray salt solution (50g/lit of water) in the pen. This will helps in controlling coccidiosis.
- Spray X-185 @ 4ml/lit of water in the shed with power sprayer. To drench wet the shed completely, 40 lit of water require for 1000 sqft area with correct quantity of disinfectant in it.
- Terminal disinfection may be done by either any one or both of following ways
    1. Fumigation
    2. Thermal fogging
- Fumigation is done with formaldehyde and KMnO4 (Potassium Permanganate). Ideally, for 1000 sqft area 2.6kg KMnO4 is required with 5.2 lit of formalin.
- House should be kept closed air tight for 24 hours.
- Thermal Fogging: This is done by thermal fogger. Thermal fogging of VBFA-400 @ 2 liter in 3 liter of water for 1000 cu meter in the shed.

- After thermal fogging keep shed closed with curtains for at least 24 hour.
- One or two disinfectant sprays of Biobuster @5gm/litre, B-904 @ 4ml/lit or X-185@ 4ml/lit with 2 days interval.
- Once terminal disinfection programme is over, keep the shed closed till chick/bird arrival. This can be ideal gap between two batches for breaking the disease cycle.
- Open the shed a day or two before arrival of chicks and spray B904@ 4ml/lit.

"SUBSEQUENT TO THE DISINFECTION PROCESS PLEASE ENSURE THAT OUTSIDE FOOTWARE REMAIN OUTSIDE THE SHED AND INSIDE FOOTWARE REMAIN INSIDE"

3.8 Disposal of dead birds

A closed postmortem room and disposal pit or incinerator should be constructed away from the sheds. Quickly, properly and hygienically dispose of dead birds in a properly designed pit or incinerator. Follow government rules and regulations. Do not keep dead birds in feed room of the shed instead use disposal bin for this purpose. Keep a dedicated person who will look after collection of dead birds from all sheds, post mortem room cleaning, operating incinerator and maintenance of waste disposal area.

3.9 Manure Disposal

Manure should be removed from the shed and transported away from the farm in closed contained or in bags or trolley covered with curtain to avoid spillage on farm roads. It should be done cautiously and quickly as possible. Follow vehicle bio-security.

3.10 FLY CONTROL

Fly control should be an integral part of any poultry operations. Fly populations, if not properly managed, can spread diseases in poultry and can result in public health nuisance in nearby villages. Fly is an important mechanical vector of many human and poultry diseases. The most common species encountered in poultry operations is house fly (Musca domestica). This fly breeds in moist, decaying plant material, spilled feed, waste egg material and wet manure. Adult fly lay eggs on wet manure as well as in cracks and crevices under the surface of the breeding material. Eggs hatch into white, cylindrical larvae (maggots) in 12 to 24 hours. Maggots pass through three growth stages to complete their development in four to seven days. Mature larvae form a dark reddish-brown puparium from the larval skin and then pupate. The adult fly emerges after a pupation stage of three to four days. Adult flies live an average of three to four weeks.

Managemental practices to keep fly population under control

1. Dry manure management is highly effective in reducing fly populations. Eggs are laid on breeding media like manure and larvae hatch out in moist or wet material where they remain until ready to pupate. Pupation may occur in a drier location than where the eggs hatch. Freshly laid manure has approximately 60-80% moisture. If moisture level can be reduced to approximately 30%, flies will no longer find it an ideal site for laying eggs. Proper ventilation is required to maintain manure dry.
2. Frequent removal of manure (weekly once) prevents fly buildup by breaking the breeding cycle is another approach for fly control if feasible.
3. Another method of making manure unattractive to flies is to add water and make the manure liquid. Maintain liquid status of manure by adding water frequently as needed. Concrete floor may be of help to save water.
4. Water management with respect to the moisture content of manure is important for effective fly control. Regulate the water flow to nipple system and prevent/repair water leaks. Drain and fill up low water lodging area in the farm. Repair and clean drainage line of shed regularly.
5. Quickly remove dead birds and broken eggs.

6. Clean up and dispose of feed spillage immediately.
7. Treat the flock for diarrhea.
8. Avoid high salt content in the feed which may lead to increased water consumption as well as wet droppings.

Mechanical control of flies

Mechanical control can be accomplished through the use of various types of fly traps, glue strips, electrically operated insect killer (fly ban, fly killer) and mechanical burning. Mechanical burning of flies in their resting areas like chain link mesh, trashes and perlin etc may be helpful to reduce adult fly population.

Chemical control of flies

Chemical control consists of the application of insecticides to control flies and should always be considered supplemental to sanitation, managemental options to control flies and mechanical fly control measures. Rotational use of a variety of different classes or groups or families of insecticides can minimize the chances of developing chemical resistance. The chemical methods can be categorized as follows:

A. **Larvicidal through feed** utilize cyromazine (Larvadex), an insect growth regulator. When blended into a poultry feed, it controls manure breeding flies. It kills immature life stages and does not affect natural biological control agents in the manure. When flies become active or after housing of new flock in caged layer incorporate Larvadex in feed at recommended dose for 4 to 6 week and should be repeated only after four months interval or when fly population increases. Over reliance on this method of fly control may result to resistance. Other product like Muscatrim (Venky's) is available in market to be used as larvicidal through feed.

B. **Larvicidal sprays** (Dimilin, Larvin) are applied directly to the manure surface to kill larva. To obtain desired results, the larvicide must penetrate the manure and come in contact with larvae. Larvicide application will give short term fly control and will kill natural biological control agents. Treatments will then need to be repeated. However, spot treatments of small area with high number of maggots can be effective.

C. **Surface Residual Sprays** are applied inside and outside the shed or building to control adult flies. Manufacturers recommendations should be followed as some of the residual insecticides are not recommended to spray inside the shed in presence of birds. Avoid contamination of feed and water. Do not spray on birds.

D. **Baits** (sugar baits with insecticide) are effective for suppressing low fly populations and maintaining populations at a low level. It is economical and easy to use method. Place baits in passage, rat proof sajja, near office and mess. Care must be taken that baits not mix in the feed accidentally or eaten by birds.

3.11 RODENT CONTROL

Rodents are known carriers of many poultry diseases and they are the most common reason for re-contamination of a cleaned and disinfected poultry facility. They are also responsible for house-to house spread of disease on a farm. In addition to bio-security reasons rodents are responsible for damage to buildings and electrifications, they eat feed and they waste and contaminate more than they eat. It is assumed that a colony of 100 rat will consume over 1 tonne of feed in 1 year.

A day time sightings of rats usually means high infestation of rat in the shed. Night time round of sheds is necessary to judge the rat population. Rat presence may also be detected by burrows, pathaways, claw marks, damaged wiring or curtains and unusual excitement in the flocks etc.

How to control rodents in the farm?

1. It is recommended to construct rat proof sheds and other ancillary buildings.
2. Rodents do not like to be exposed. The farm should be free of waste material, debris, spilled feed and used feed bags and tall grass that might provide hiding space for rodents.
3. Close all rat holes on regular basis.
4. The perimeter of the house should have a 1 m (3 ft) area of crushed rock or concrete to prevent rodents from burrowing into the houses.
5. Feed and eggs should be stored in rodent-proof areas.
6. Use of rat trap or mouse trap is useful for eliminating rodents for small populations. Rats are distrustful of anything new in their environment, so leave baited non set traps out for 4-5 days to allow them to get used to traps. Ensure that previous baits have been taken before actually setting the traps. Check traps daily and remove and dispose dead rodents.
7. Glue boards are very effective against mice. Glue boards will not work well if there is too much dust. Check glue board daily and remove and dispose dead rodents.
8. Use rodenticide when control of moderate to large rodent population is necessary. Many time rodent may develop bait shyness, at that time use another formulated product or different attractant. Prebait using bait without rodenticide for about 1 week to get accustomed to the bait is necessary. Place bait in area of high rodent activity. Bait should be placed 20 -30 feet apart. Bait should be placed in bait stations or bait boxes that allow ready access by rodents but prevents large animals, birds and children from gaining access. A baiting station designed from PVC piping (figure-2) has proven very effective in reducing rodent numbers. It is safe, effective, economical, homemade baiting station.

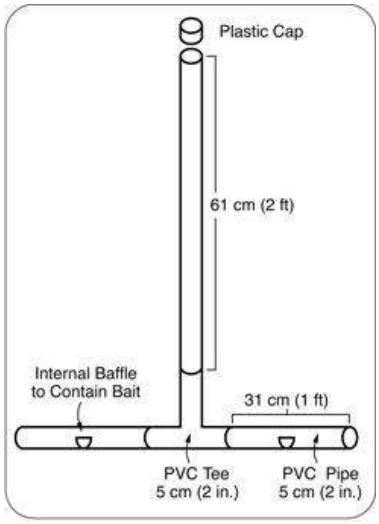


Fig-1: PVC Bait station for rodent

3.12 Control of wild Birds and other animals

Farm should be fenced by dog proof fencing to prevent entry of large animals and dogs in the farm premise. Proper disposal of domestic and egg waste to avoid attraction for dogs. All sheds should be protected with 16G and ¾ inch chain link mesh to prevent entry of wild/stray birds like crow, cranes etc. in the shed. Sparrow proofing of poultry house is mandatory. Regular checking and maintenance of sparrow proofing should be practiced. Keep shed door closed all the time after use.

Avoid spillage of feed out side shed, near silo and feed go down which may act as feed source for wild birds. Do not plant trees which may act as source of food and provide cool habitat for wild birds. Avoid green vegetation near sheds as it may become source of insects for wild birds. Regular removal of cob webs from trashes, perlins and chain link mesh. Measure taken to control movement of wild birds near sheds are fixing of radium strips, fixing of anti bird net surrounding shed, making sound and use of crow scares.

4. FEEDING RECOMMENDATIONS FOR COMMERCIAL LAYERS

4.1 GENERAL NUTRITION

Increasing animal production and human population globally has put great pressure on the available resources resulting in the price spiral of feed raw material costs. Now a challenge remains for nutritionists to meet feed quality, performance of layers, while minimizing diet costs.

4.1.1 Cost of production

In the production cost of eggs from commercial layers, feeding accounts to 85 per cent including 11% for rearing. Moreover, there is exorbitant increase in the ingredient cost, without commensurate increase in the sale price of eggs. So there is urgent need to look into all possible avenues for reducing the feeding cost.

4.1.2 Basis of Recommendations

The concepts of digestible amino acids, Ideal amino acid ratios, use of synthetic amino acids and feed consumption based formulations are considered in the recommendations. The recommendations are based on the nutrient requirements of commercial layers. The requirements are derived from the performance analysis of commercial layer flocks. Formulations based on these requirements had given excellent results in number of layer flocks. Also resulted in significant saving in feeding costs.

4.1.3 Ideal Protein

A balance between the different amino acids is necessary for optimum performance. Expressing the requirements for amino acids as a percentage of the requirement of Lysine is ideal protein ratio.

In the diet, requirement of amino acids is to be satisfied are Lysine, Methionine, Cysteine, Threonine, Tryptophan, Isoleucine, Valine. For each diet, ideal protein ratio is recommended that will result in most economic performance for commercial layers.

4.1.4 Digestible Amino Acids

The recommendations are based on digestible amino acids. They are most suited to meet the requirement of the birds. They reduce the necessary safety margins and assess the raw material according to their true biological value. Digestible amino acid based formulations, that also meets the ideal protein ratios facilitate the reduction of crude protein in the formulation with out affecting the performance. The result is least cost formulation. The values of digestible amino acids are based on the published reports of Evonik Industries. (Appendix - 7)

4.1.5 Low protein diets

Feeding low protein, amino acid balanced diet would benefit layers in optimizing the performance and can yield significant economic advantage with regard to total feed cost and income over feed cost. Additionally such diets are Eco-friendly (less nitrogen excretion); reduce detrimental effects on environment and potentially save resources for more sustainable production.

4.1.6 Feed Quality

The feed ingredients used in all phases of production for the flock must meet the following criteria:

1. Poor smell or taste of the ingredient may indicate adulteration, causing feed to be non-acceptable to the birds. Excessive fine particle or dustiness from over milling reduces palatability of the feed.
2. Feed must be free from contamination by all pathogens, chemicals and toxins. Especially important is freedom from contamination by Salmonella species. In many areas of the world, the contamination of animal by-products, such as meat and bone meal, fish meal, blood meal and hydrolyzed feather meal is widespread. As a general rule when animal by-products cannot be guaranteed 100% free from contamination, **DON'T USE THEM**.
3. Some ingredients, soybean meal for example, must be correctly treated, usually by heat, to destroy anti-nutritional factors. It is essential that this be done correctly.
4. Contamination during storage and delivery must be avoided. Wild birds, rodents, etc. should be physically prevented from coming in contact with feed or ingredients while in storage. Improper cleanout of the delivery vehicle can cause contamination from the previous cargo.
5. It is important to analyse feed on regular basis for major (most commonly protein, fat, calcium, phosphorus) values. Knowing the actual analysis of the feed will help to investigate possible nutritionally related production problems. A sample of every load of feed should be kept for 1 month after delivery in properly sealed containers to help diagnose acute production drops.

4.1.7 Feed acidifiers

Feed acidifiers are generally organic acids (Formic, Acetic, Propionic, Lactic, Butyric, Malic, Citric and Benzoic). Lowering of pH inhibits the bacterial growth in the intestine. In addition, they have direct bactericidal action, enhanced digestibility, improved FCR and provide substrate for enterocytes. So feed acidifiers are recommended.

4.1.8 Role of liver

Healthy liver results in good egg production with an excellent egg shell quality. When the liver is suffering, production and egg quality is affected. All precautions to be taken for preventing damage of liver due to feed toxins.
Liver is linked with the eggshell quality through the vitamin D metabolism. Dietary vitamin D is not directly active and needs two hydroxylations to become metabolically active. The first one is done in the liver and the second takes place in the kidneys. Once these hydroxylations have occurred, vitamin D is able to increase the intestinal permeability to calcium, induce the calcium binding protein synthesis and calcium is then transported from intestine to the shell gland for egg shell formation.

Avoid fat birds by suitable modification of feed formula after estimating bird energy balance. The most efficient lipotropic factor is choline. Classical added choline levels used for layer diet are usually around 250 ppm, but for an efficient action on liver, 500 to 1000 ppm of added choline is recommended. Vitamin B12, folic acid and vitamin E improve the liver condition.
Fatty liver or unhealthy liver is associated to bad egg shell quality, due to the lack of vitamin D hydroxylation. Preventing fatty liver and maintaining a healthy liver insure good egg shell quality. Sorbitol and inositol are complex sugars which could be useful to improve the fat metabolism and prevent fatty liver. To a lesser extent betaine and methionine could prevent fatty liver by their action of methyl group donors.

4.1.9 Heat Stress

Heat stress will also result in lower feed and energy consumption. As a result, increasing the energy content in the feed can result in better body weight gain, egg production and egg weight, especially when the effective ambient temperature is high. Oils are concentrated sources of

energy and can be useful in increasing the energy content of feed. The digestion of fat produces less body heat (fat has a relatively low heat increment), which is useful during periods of heat stress.

4.1.10 Formulating for feed intake

The hen's feed consumption rate is governed by several factors, including body weight (or age), rate of egg production, egg weight, effective ambient temperature, feed texture, dietary nutrient imbalances and dietary energy content. The later is especially important because hens tend to increase or decrease feed consumption to maintain energy intake within a given range determined by the hens' physical capacity for feed intake. Hens will attempt to consume more of a low energy diet than of a high energy diet. Only in special cases will hens adjust their feed consumption to meet their needs for specific nutrients, but usually not with great accuracy. Accurate and frequent estimates of actual flock feed intake are critical to effective feed formulation.

4.2 NUTRITION FOR EGG WEIGHT AND SHELL QUALITY

4.2.1 Strategies for control of Egg Weight

- Reducing feed intake by controlling the number of feedings.
- Reducing the consumption of oil without affecting the dietary energy content.
- Reducing the body weight at point of lay and maintaining body weight below the standard.

The opposite strategies can be used to increase egg size.

4.2.2 Eggshell Quality: Strategies to improve egg shell quality in late lay

- Feed a pre lay diet.
- Formulate diets for observed feed consumption.
- Control egg weight.
- Increase dietary calcium with age.
- Use 65% marble grit of 2-4mm and rest lime powder.
- Increase the consumption of vitamin D3.
- Increase the consumption of organic trace minerals.
- Replace part of the dietary salt with sodium bicarbonate during hot weather.

4.3 FEED MANAGEMENT

Feeding should be done at least twice in a day. More number of feedings are recommended when feed consumption is low. Early morning, evening and night feeding may be practiced to encourage feed consumption during extreme summer.

Regularly empty, clean and disinfect feed bins and avoid unnecessary buildup of dusty, stale, mouldy and unpalatable feed. Birds should be allowed to occasionally empty feeders. Inspect the feed visually for particle size, colour and smell. Any significant deviations to be reported.

4.4 QUALITY OF FEED INGREDIENTS

Ingredient specifications (guideline for purchase of row material) are given in appendix-8.

Vitamins

1. Procure pure form of Vitamins
2. Store Vitamins in the air conditioned room
3. Analyse for purity(Assay)
4. Base material for premix should be preferably ground maize
5. Add at least 0.5% Refined Oil
6. Coated Vitamins are preferred for Pellet feed
7. Do not store the Premix for longer time
8. Make primary Premix and then go for Secondary Premix

9. Insure thorough mixing

Added vitamin level recommendations include safety margins for loss during transport, storage and processing of the feed. The vitamins contribute only about 2.5% to the total cost of feed. However, they have significant effect on bird's performance and chick quality. The recommended added vitamin levels are capable of supporting recommended performance levels under practical field conditions. (Appendix-12)

Minerals:

1. Procure pure form of Minerals
2. Analyze for purity(Assay)
3. Base material for Premix should be preferably Limestone Powder
4. Make primary Premix and then go for secondary Premix
5. Ensure proper grinding of Minerals
6. Insure thorough mixing

Organic minerals are recommended.

4.5 REARING PERIOD NUTRITION

4.5.1 Chick Starter 1 & 2 (0-9 weeks)

Starter ration aims to produce a good skeleton, organ development, feathering, skin condition and help to promote an active immune system. At 6 weeks already 85 per cent of the skeleton has been developed. This is achieved by feeding the starter feed ad libitum with the correct balance and absolute levels of essential amino acids, energy, vitamins, minerals and a minimum concentration (1.3 per cent) of Linoleic Acid.

Presenting feed in crumb form makes it easier to eat, reduces the time taken in eating and encourages growth. The energy cost of eating, thus saved, gives an improvement in feed conversion ratio.

Starter1

Normally it is adequate to feed Starter-1, to 4 weeks of age or when the body weight is around 240g. The cumulative feed consumption of Starter 1 feed in this period is about 580g. Double crumbled 3mm pellets is giving good results.

Starter 2

Starter 2 feed is to be given up to 9 weeks of age or when the body weight of 770g is achieved. The expected feed consumption of Starter-2 feed is around 1500g. Single crumbled 4mm pellets is giving good results.

4.5.2 Grower/Developer

Introduction of developer feed results in significant saving in rearing feed costs.

A reduced nutrient density and an increased content of crude fiber (5-6 per cent), during this phase is beneficial. It can positively influence the development of the digestive tract, the crop size and the appetite of pullets. This is beneficial for young layers, especially at the start of production, when the appetite of the bird is sometimes not sufficient enough. De oiled rice bran can be used as a source of crude fiber in corn soya diets. This diet is to be given up to 15 weeks of age.

The achievement of good growth and a rapid increase in feed consumption at start of lay depends on the chicken having a well developed digestive system, especially a good strong gizzard. After 10 weeks give as a calcium source, 50 % limestone powder and 50% marble grit with particle size of 2-4mm.

4.6 PRE-LAY NUTRITION

It is to be given two weeks before the onset of production (about 16 weeks of age). The pre-layer diet has about twice the calcium content of developer ration as well as higher levels of protein and amino acids. Feeding such a diet for about two weeks prior to the onset of lay is therefore beneficial. This diet improves flock uniformity by providing a better nutrient supply to late maturing birds and by enabling early maturing birds to obtain sufficient calcium for egg shell formation.

Utilization of pre lay diets has a strong positive effect on egg shell quality. Early flocks which are starting to lay in the rearing house or fed with a regular developer diet have a strong risk to be very early demineralized. Every egg laid with non-adequate calcium feed leads to 1g calcium loss from the skeleton. Pre lay diet with 2.5 per cent calcium is covering the calcium exported through the first eggs and prevents early decalcification. Egg shell quality is then improved at the end of the laying period. A safety advice is to use pre lay diet two weeks before the expected start of the lay. This practice prevents early decalcification, makes robust medullary bone and help to increase feed consumption at start of lay.

4.7 LAYING PERIOD NUTRITION

4.7.1 Phase1

Phase-1 feed is to be used from 0.5% production to 40 weeks of age. In this phase 670mg of lysine is recommended. The ideal amino acid ratios for best performance are specified. The minimum crude protein recommended in this phase is 15.5%. (Appendix-10).

4.7.2 Phase-2

The phase-II feed is recommended from 41 weeks. The minimum lysine specified for this phase is 650mg. The ideal Amino Acid ratios are also specified. The minimum protein recommended for this phase is 15%. (Appendix-11).

5. MANAGEMENT

5.1 BROODING MANAGEMENT (0 – 7 WEEK)

First few days of life is critical for chicks, as their thermoregulatory system is not developed they are unable to maintain their body temperature on its own. Proper brooding helps to develop immune system of chicks.
BV380 layers are well adjusted in floor rearing as well as cage rearing. But rearing in cages is recommended during brooding and growing period followed by housing in layer cages.

5.1.1 BEFORE CHICKS ARRIVAL

Before arrival of the chicks check that everything is in good working order. Thoroughly cleaned and properly disinfected house with all equipments and litter material should be ready at least 2 week before chick arrival. Please refer shed cleaning protocol in chapter-3.
Spread sun dried litter material (Rice husk) evenly. A Suitable disinfectant spray is to be done inside and outside shed. Uneven bedding material can restrict access to feed and water and may lead to a loss in flock uniformity.
Arrange gas brooders, feeders, drinkers and side curtains etc well before arrival of chicks.
Start heating devices (brooders) 24 hours prior to expected chick arrival so that all equipments (cages), floor and litter material should be warm at the time of chick placement. Before chicks are placed, fill drinkers or nipple line with lukewarm clean water
Procure feed, medicine, vaccine and other consumable from store one day prior to chick arrival.

5.1.2 PLACEMENT

Ensure brooder and/or house temperature before placing chicks. Chicks are under stress due to long distance transportation so it is recommended to place chicks as early as possible and allow them to drink water. Vaccination may be started once the chicks are settled.

5.1.3 SPACE REQUIREMENT

5.1.3.1 Deep Litter

In deep litter brooding, during first 2 -3 weeks provide 0.3 to 0.4 sqft per chick floor space and then increase gradually as age advance. This will help to maintain required temperature in brooder house and also reduce brooding cost per chick. After 2 -3 weeks increase floor space per chick up to 1 sqft per female up to 8 weeks of age. Feeding space required is 2.5cm per chick up to 4 week and 5 cm per chick from 5 to 8 weeks of age.

5.1.3.2 Cages

Two tier reversible cage design for chick cages are recommended for layer chicks. Cage front of 18 inches, depth of 18 inches and height of 15 inches are recommended up to 7 weeks. During first two weeks of brooding period more number of chicks can be placed per chick cage (maximum 15 chicks per cage – 18sqinh/chick). As age advances reduce number of chicks per cage and keep 8 chicks per cage (40.5sqinch/chick) up to 7 week of age.
Cage Dimension for Chick Cages

Particulars	Specifications
System	2 or 3Tier (reversible)
No. of Chicks/cage	8
Cage Front	18 inches
Cage Depth	18 inches
Cage Height	15 inches

Feeder	22G Aluminium or PVC
Floor Space/chicks	40.5 sq in
Feeder Space	2.25 linear inch
Cage bottom mesh	½ " x ¾ " upto 2 weeks , ¾ " x 1 inch from 3 to 7 weeks

Ensure that all chicks have at least an access to 2 nipples.

5.1.4 WATER

Flush nipple line before arrival of chicks to ensure that line is free from residual disinfectants. Chicks are transported from long distance so ensure that after arrival chicks should drink water with some electrolyte and vitamins. Adjust height of nipple line so that all chicks should drink water comfortably. Place one additional chick drinker in every cage for first one or two weeks. Drinking water temperature should be 25-30^{o}C for first week. Make sure that all birds have at least an access to 2 nipples. Avoid water spillage and leakage. Daily flushing of nipple line through plain water with high pressure is recommended.

5.1.5 FEED

After one or two hours of placement offer starter -1 feed. Spread paper sheet over the cage bottom for first one or two weeks. Use of mini (baby) feeders may reduce feed wastage and contamination by fecal material. Place small quantity of feed on paper sheet as an easy feed access. These paper sheets may be removed after one or two weeks. In case of floor rearing during first one week spread feed on paper or corrugated sheet. Detail nutritional recommendations are given in separate chapter.

5.1.6 LIGHTING

During first week it is recommended to give 24 hours of light. Detail Lighting programme is explained in lighting chapter.

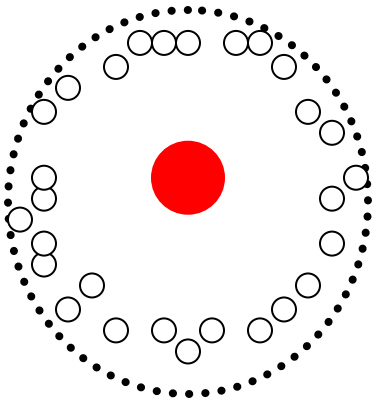
5.1.7 TEMPERATURE

Chicks cannot regulate their own body temperature until they are around 12–14 days of age. Ideal body temperature must be attained by providing optimal environmental temperature. Preheating the house is vital as floor temperature at chick placement is as important as air temperature. Stabilize temperature and relative humidity for at least 24 hours prior to chick arrival. In winter season double curtain may be used to maintain required temperature inside shed. Ventilation should be provided by creating small window or air exchange to facilitate elimination of accumulated carbon dioxide gas generated through gas brooders.

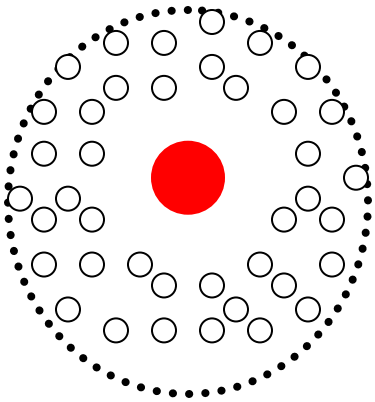
5.1.7.1 DEEP LITTER BROODING

In Deep litter brooding, spot heating devices are used to provide optimum temperature to chicks under hover. A hover with electric bulb, electric heater, gas brooders are used commonly. Temperature regulated by adjusting the height of brooder and gas flow. During first week of brooding, temperature under hover (at chick level) should be 90 -95 ^{o}F. In second week maintain brooder temperature of 85 ^{o}F followed by 80 ^{o}F in subsequent weeks.

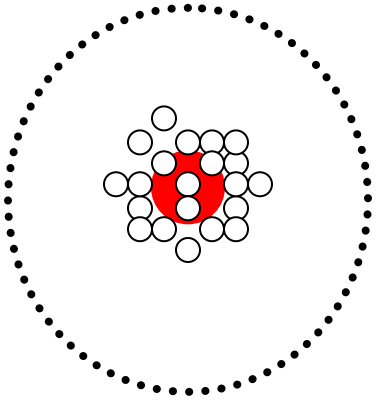
Chick behavior is the best indicator of correct brooder temperature. With spot brooding, correct temperature is indicated by chicks being evenly spread throughout the brooding area. If chicks crowd under the brooder indicates temperature is too low and if chicks are close to the surround indicates too high temperature. In the diagram, the brooder area is shown as the red center circle.



TEMPERATURE TOO HIGH



TEMPERATURE CORRECT



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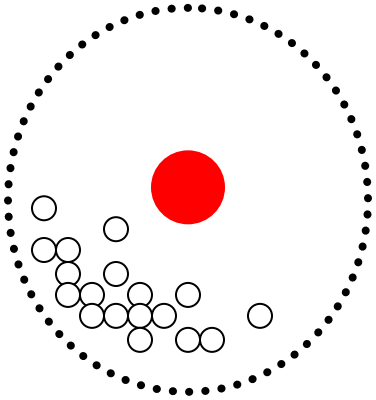

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5.1.7.2 CAGE BROODING

In cage brooding, whole house heating recommended. It may be achieved through use of properly arranged electric bulbs, room heaters, gas brooders or most commonly used space heaters. Air circulating fans may be used to distribute warm air through out the house. Gas brooders may be hanged in passages between cage rows at a height of 3 – 4 ft above the cage top. Ensure that there should not be any spot heating as chicks under particular hot spot may get dehydrated. Use space heaters or gas brooders with thermostat to avoid over heating and save the gas. In cage brooding, temperature of house should be maintained between 85 to 90^{o}F during first week of brooding and reduce 5 ^{o}F in subsequent week until 75 ^{o}F by 3-4 week depending on season. Weekly manure removal from shed is recommended to control flies.

5.1.8 HUMIDITY

Humidity is an important factor for chick comfort. Lower relative Humidity (RH) results in dehydration of chicks, lowered growth rate and livability. During first few weeks maintain relative humidity between 60 to 70% if possible. Use of gas brooders along with nipple drinkers in brooder sheds, lower down RH up to 25%. Frequent spray of sanitized water in the shed may help to increase RH.

5.1.9 VENTILATION

Adequate ventilation is required in brooding sheds to provide easy air exchange in order to eliminate Carbon dioxide and ammonia from the shed. Do not use air tight curtains. It is recommended to keep a gap or window of 3-5 inches between ceiling and side curtains.

5.1.10 BEAK TRIMMING

It is critical and most important operation of rearing period. Beak trimming is done to reduce feed wastage and cannibalism (pecking).

5.1.10.1 FIRST BEAK TRIMMING

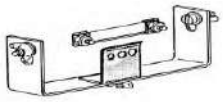
It should be done between 7–10 days of age using a precision beak trimmer. For beak trimming hold the chick in one hand with the thumb behind the head holding the head firmly in position resting the beak on the forefinger. Tilt the chick's beak upwards at an angle of 15 º above horizontal and cauterize the reinforced side edges of the beak to avoid unequal re-growth.

Cauterization contact time should be between 2 and 2.5 seconds.

The proper size hole should be selected to provide the width of 2.5 to 3 mm between the nostrils and the cauterizing ring. Severe cutting of beak may cause irreversible damage to the chicks and affect performance of the bird. A cherry red color blade with approximately 595°C (1100°F) temperature has been recommended for proper cauterization

For beak trimming of day old chicks in the hatchery, an infrared beak trimming method is also in use. It uses a non-contact, high intensity infrared energy source to treat specific portion of beak tissue. In this method, initially beak remains intact but after few weeks the sharp hook of the beak erodes.

Figure: a) Precision beak trimmer guide plate holes, b) chick after 10 days beak trimming, c) chick after infrared beak trimming, d) properly beak trimmed pullet at 18 week of age.



a)Guide plate holes for precision beak trim

b) 10 day old chick immediately after beak trim.

5.1.10.2 PRECAUTIONS

- Ensure that the flock is healthy.
- It is critical operation and it should be done by well trained staff under strict supervision of farm manager.
- Use electrolytes and vitamins (containing vitamin K) in the water two days before and two days after beak trimming.
- Pain reliever (Aspirin 500mg/1000kg bwt) is to be given on the day of and two days after beak trimming.
- Keep feed at the highest level for few days after beak trimming. Ensure that birds are drinking water freely.
- Proper cauterization to avoid bleeding. Re-cauterize the bleeding beaks.

5.1.10.3 SECOND BEAK TRIMMING

It is recommended to do second beak trimming at the age of 12-13 week. It may be done by ordinary beak trimmers. Insert a finger between the 2 mandibles and cut the beak perpendicularly at a right angle to its long axis, so that after cauterization about half of the length of the beak between the tip and the nostrils is left. Cauterize each mandible with care particularly at the sides of the beak so as to round off the sides of the beak and avoid lateral re-growth.

5.1.11 BODY WEIGHT

Sample body weight of 50 to 100 birds is taken. More detail regarding body weight sampling is described later in this chapter.

5.2 GROWING PERIOD MANAGEMENT

BV300 layers are successfully reared on deep litter as well as cage system. Separate grower sheds are recommended. It is recommended to shift layer birds to grower cages after 7 – 8 weeks of age when body weight reaches 550g.

After a good starting, during the growing period, the flock should be managed in order to get a suitable development to allow the birds to reach their highest potential to produce eggs.

The objectives during growing period are:

- to achieve the recommended weight at 5 % production
- to establish a good feeding behaviour pattern
- to develop the digestive tract (crop and gizzard)
- to obtain a good uniformity of 80 % minimum

These objectives could be achieved thanks to:

- a correct stocking density and housing conditions
- a lighting program adapted to rearing conditions
- a good standard of beak trimming
- a good management of the feeding program and feeding techniques

5.2.1 SPACE REQUIREMENT

5.2.1.1 Deep Litter

In deep litter growing after 8 weeks provide 1.5 sqft per bird till shifting to layer house. Feeding space required is 7.5cm per bird during growing period.

5.2.1.2 Cages

Raised platform house with minimum 5 feet height up to rat proof sajja are recommended. Two or three tier reversible cage design for grower cages are recommended for layer chicks. Cage front of 20 inches, depth of 15 inches and height of 17.5" inches are recommended for grower cages which can house 5 birds per cage with 60 sq inch space per bird.

Cage Dimension for Grower Cages

Particulars	Specifications
System	2 or 3 Tier (reversible)
No. of birds/cage	5
Cage Front	20 inches
Cage Depth	15 inches
Cage Height	17.5 inches
Feeder	22G Aluminium or PVC
Floor Space/chicks	60.7 sq in
Cage Bottom mesh	1" x1" mesh
Feeder Space	4 linear inch
Water	Height adjustable nipple line with acess of 2 nipples for every birds.

5.2.2 BODY WEIGHT MONITORING AND GRADING

A weekly control of the growth is a must to check the real evolution of the flock. Early detection of abnormal weight gain is of extreme importance to determine what corrective actions must be taken. Late attempts to correct low body weight are not efficient at improving body composition and frame size.

Weekly sample body weight should be taken from first week to 18 week. Biweekly from 19th week to 30th week and monthly from 30th week to liquidation. Random sampling of 100 birds is recommended to obtain a good estimate of body weight mean and uniformity. Identify and mark specific cages in different parts of the house and weigh the birds from the same cages every week to obtain correct information about increase in body weight every week. In deep litter system, random samples from all pens must be taken. Digital scale or dial type weighing scale with 20g accuracy is recommended. Scale should be checked and calibrated with standard weight bart before sample weighing. Calculate average weight of flock and compare with standard weight.

5.2.2.1 Uniformity

We advise carrying out individual weighing and using histogram type weighing sheets which shows at a glance the weight distribution within the population.

The quality of a flock is judged, as much as anything else, by its uniformity. Uniformity is determined by calculating % of birds weighing within ± 10 % of the mean body weight. A flock is uniform when at least 80 % of the weights lie within ± 10 % of the mean.

Under weight or low uniform flock indicate over crowding, insufficient feeder/water space, disease condition, improper beak trimming or less nutrient intake. Identify and correct the problem.

$$\text{Uniformity\%} = \frac{\text{No. of birds within range of } \pm 10\ \% \text{ of the mean wt}}{\text{Total birds weighed}} \times 100$$

5.2.2.2 Grading

Weigh all the birds individually, during 12 to 15 week of age. Calculate average body weight, range of weight and flock uniformity. Separate birds having body weight less than 10% of mean body weight from rest of the flock. Give higher nutritional density ration along with supporting treatment like liver tonic and vitamins preparations so as to bring these lower body weight birds to main stream.

5.2.3 LIGHTING

We advise to give total 14 hours light during growing period to encourage feed consumption during cooler hours of the day. The detail lighting programme is given in separate chapter.

5.2.4 FEEDING

Please refer nutrition chapter for detail feeding recommendations during growing and pre-lay feeding. From start of 16th week it is recommended to give pre-lay feed up to 0.5% hen day production after that introduce phase-1 feed.

5.3 LAYING PERIOD GENERAL MANAGEMENT

5.3.1 CAGES SPECIFICATIONS

Two or three tier cage layer house with raised platform is recommended. More number of cage rows in a layer house could hamper ventilation and performance.

Cage Dimension for Layer Cages

Particulars	Specifications
System	3 Tier (reversible)
No. of birds/cage	4
Cage Front	20 inches
Cage Depth	13 inches
Cage Height	17.5 inch – front 15 inch - rear
Feeder	22G Aluminium or PVC
Floor Space/bird	65 sq inch
Feeder Space	5 linear inch

Remark: make sure that all the birds have at least an access to 2 nipples

5.3.2 TRANSFER

Transfer pullet from grower cages to layer cages latest by 15-16 week of age. Late transfer may affect flock performance during laying period.

Transfer is a major source of stress, accompanied by changes in environment and in equipment. Supportive care to reduce stress such as water-soluble vitamins, probiotics, and vitamin C should be used three days before and three days after the transfer.

Anti coccidial treatment like Amprolium should be given just before transfer. Coccidiosis is predisposing factor for necrotic enteritis, it causes production drop and mortality. Flock should be treated by suitable antibiotic.

Any sex slips should be removed at transfer.

5.3.2.2 AGE AT TRANSFER

Because of the stress to which pullets are subjected during transfer and immediately afterwards, it is extremely important that transfer be completed before the appearance of the first eggs. Most development of the reproductive organs (ovaries and oviduct) occurs during the 10 days prior to the first egg being laid. Therefore we recommend scheduling the transfer at 15 -16 weeks of age.

5.3.2.3 ENCOURAGE WATER CONSUMPTION

Birds can become dehydrated during transfer. The water loss is between 0.3% and 0.5% per hour according to atmospheric conditions (4 g/hr at 20°C, more than 8 g above 30°C). The water drinking devices must have been triggered and purged before pullets' arrival to ensure they are working properly. The newly arrived pullets should drink before feeding. The absence of feed at transfer helps them find the drinkers more easily. Wait for 3 to 4 hours before distributing feed and check that all the pullets drink properly. A daily check on water consumption is of paramount importance. If nipple drinkers are used in the laying house but the pullets have not been reared with nipples, increase the pressure and allow some loss of water during the first few days.

5.3.3 WATER

Water is essential and the cheapest nutrient for the birds. Layer breeders must have fresh, clean, potable water readily available all time. If water hardness is too high or quality of water is suspicious, use of RO water may be considered. It may be convenient to have a water meter installed in the water supply system.

5.3.3.1 WATER SANITIZATION

Suitable water sanitizer should be added in drinking water. Maintain chlorine level of 2-5 ppm for drinking water. Use of chlorine bag in main storage tank is cheap and practical solution for comparatively clean, bore well water. If water is suspicious for bacterial contamination, suitable water sanitizer like Quatrena-4 (1ml/10lit) or Safe Guard (1 ml/10 lit) may be added. Permissible drinking water standards for poultry are given in appendix- 13.

5.3.3.2 WATER LINE CLEANING

Nipple line in the shed and water supply line to the shed are closed one and difficult to clean. It has tendency to generate bio-film in the water pipe line. It is recommended to flush nipple lines by plain water with high pressure daily at least for 15-20 minutes. After any medication and at regular interval of 2-3 weeks flushing of nipple lines are recommended by medicine like Aquamax. This should be done in night time after lights off. Give sufficient contact time for medicine to act and flush out all medicated water and fill up nipple line with fresh clean water before light on in the morning. Cleaning of shed tank is also necessary at the time of nipple line flushing.

After transfer (Brooding and growing sheds) and liquidation (laying sheds), flush nipple line, clean shed tank and keep it dry. If possible, dismantle all nipple line of the shed, clean thoroughly by use of descaling solution, remove scales, bio-films by scrubbing through bottle brush in vacant shed between batches.

5.3.3.3 WATER SAMPLING

Routine check up of water for its microbial count, pH and hardness is essential. Water sample should be collected in sterile bottle. Collect water samples from shed tank as well as from end of the nipple line.

5.3.4 DIESEASE MONITORING

Random blood or serum samples (25 samples per shed) may be send to laboratory every month from 6 week to liquidation for routine titer monitoring. Based on the titer results appropriate decision for vaccination of the flock should be taken.

Feed, water and fecal samples should be send to laboratory every month for microbial analysis. Take corrective measure if contamination detected. Send routine mortality birds to laboratory at least once in a month for post mortem, isolation and antibiotic sensitivity.

Salmonella testing of flock should be done before transfer to laying sheds. Discard reactor birds if any.

Follow vaccination and medication schedule provided by local laboratory.

5.3.5 FEEDING AUTOMIZATION

Feeding atomization is recommended which may reduce feed wastage and is also labour saving. Use of automatic motorized feeding trolleys along with feed silos to store feed out side the shed may reduce feed wastage at least by about 1g per bird. It will also improve quality of feed due to less chance of contamination during storage. It also avoids manual handling of feed bags which is not labour efficient.

6. Lighting Program

In India majority of grower and layer houses of the commercial layers are open sided and natural day light enters the house through out the day period. Chickens are sensitive to changes in the duration of light and these will influence the age of sexual maturity. In addition, feed consumption is greatly influenced by the duration of day length during rearing period. Artificial light in the cool morning hours stimulates feed consumption in hot summer months.

Three golden rules of lighting:

1. Never increase hours of light during the growing period.
2. Never decrease hours or intensity of light during the production period.
3. Light stimulation can be given after attaining body weight of 1300g.

In summer months the consumption of pullets decreases significantly. To facilitate feed consumption during cooler hours we recommend artificial light during growing period. This will improve required nutrient intake and help to achieve target body weight at sexual maturity and results in improved early egg weight and sustained high peaks.

6.1 Lighting during rearing and growing period

After arrival of Day old chicks on the farm we recommend to provide 24 hours of light during 1st week of life. It helps the chicks to recover stress of handling in the hatchery and long transportation. It provides chicks enough time to eat and drink.

From 2nd week onwards up to 6 week provide 20 hours of light (4 hours of dark period between 7:30pm to 11:30pm). Dark period is required for giving rest to the chicks.

From 7th week onwards total 14:00 hours light is recommended. To provide this, start artificial light at 5:30am in morning to sunrise and in the evening from sunset to 7:30pm. Additional one or two hours of light during grower period encourage feed consumption during cooler hours of the day resulting in better body weight and over all development of body frame of the birds. Ensure availability of feed in the feeders when lights are on during cooler hours of the night.

6.2 Lighting stimulation

As body weight plays a major role in the determination of the egg weight, the light stimulation has to be done according to the body weight. In commercial BV380 light stimulation is recommended at the start of 16th week. In order to get an efficient light stimulation, the increase of light at photo stimulation has to be done in morning and it should not be less than one hour for first light stimulation.

At start of 16th week, stimulate by one hour of light (increase from 14 hours during growing period to 15 hours). To achieve this provide morning light from 4:30am to sunrise and evening light from sunset to 7:30pm. In the subsequent two week increase light by 30 minute per week to reach full light of 16 hours (morning 4:00am to evening 8:00pm).

In any case, if artificial light is not given during growing period, the light stimulation can be done from start of 16th week. In this case, to stimulate increase 1 hour light compared to prevalent day length from first day of stimulation followed by 30 minute increase per week to reach full light of 16 hours (4:00am to 8:00pm). Remember that first light stimulation has to be 1 hour minimum.

6.3 Intensity of Light

Intensity of light plays a major role in behavior of the bird. High intensity of light tends to increase the nervousness of the birds and it can result in pecking behavior. During first week of age provide 30-40 lux of light at bird level. During rearing and laying intensity of light can be ranged between 10-30 lux. Avoid exposure of birds from low light intensity to high intensity light.

6.4 Source of Light

Different light sources like Fluorescent, Incandescent and LED lights are used in poultry. Compact Fluorescent Lamps (CFL) of 14 to 23 watt are generally used to provide required intensity and uniform lights. CFL lights are preferred over incandescent lights due to lower

energy consumption. Usually 1 watt for 10 sq ft is required with CFL lighting for open sided layer house. For uniform light distribution in shed 20 feet distance between two lamps and height of 8-9 feet from platform is recommended.

6.5 Mid-night lighting:

This is an optional lighting technique that will promote more feed consumption during summer. Two to Three gram increase of feed consumption was noticed for each one hour of mid-night light. This technique involves giving light for 1 hour 30 minutes in the middle of the dark period (11:00PM to 12:30AM). Ensure feed in the feeders. The regular 16 hours of light period should not be changed. Light can be added all at once, but when withdrawing, it should be done gradually at the rate of 15 minutes per week. This may improve egg shell strength and egg weight during summer months.

Table : Typical lighting programme for commercial BV380 flocks

Age in weeks	Total Light (Hours)
1	24:00
2	20:00
3	20:00
4	20:00
5	20:00
6	20:00
7	14:00
8	14:00
9	14:00
10	14:00
11	14:00
12	14:00
13	14:00
14	14:00
15	14:00
16	**15:00**
17	**15:30**
18	**16:00**

Note: To give 20 hours of total light, give dark period from 7:30pm to 11:30pm. To give 14 hours of total light give light from 5:30am in the morning and to 7:30pm in the night. To give 15:00 hours of total light give light from 4:30am in the morning and evening up to 7:30pm. To provide 15:30 hours of total light give light from 4:00am morning to 7:30pm evening and for 16:00 hours of total light start morning light from 4:00am to 8:00pm in the evening.

Key Points:

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

7. MANAGEMENT IN EXTREME WEATHER

7.1 SUMMER MAMAGEMENT

Chickens, unlike most other animals, do not possess sweat glands to aid in heat loss. The chicken removes excess body heat in following ways:

Radiation: Transfer of heat by electromagnetic means is an important method of heat control. During hot weather birds will raise their wings to allow heat to radiate from poorly feathered areas, such as under the wings.
Conduction: Conduction involves the transfer of heat from a warm surface to a cooler surface such as cages, floor etc.
Convection: Moving air over birds is the most effective way to reduce heat stress. If the air is not moving quick enough, heat will begin to build up around the birds, which will increase heat stress. Proper ventilation is the key to keeping birds cool in hot weather.
Excretion: Excretion is another method birds use to keep cool. Birds normally double their water intake during hot weather and excrete heat through urine and wet feces.
Water Evaporation: Water evaporation occurs on the surface of the skin and from the respiratory tract. Panting is the most obvious clinical sign of heat stress in poultry.
The normal body temperature of chicken is 41°C. When environmental temperature is between 24 to 37°C, radiation, conduction and convention heat losses are usually adequate to maintain the bird's body temperature. When environmental temperature approaches body temperature of the bird, the efficiency of these heat loss mechanisms diminishes. At this point evaporating cooling becomes a major heat loss mechanism of the bird. Bird starts panting (open mouth breathing) or hyperventilate to increase evaporative cooling. When panting fails to prevent the rise in body temperature, the birds become listless, then comatose, and soon dies.
Heat stress has several serious and economical effects on poultry. High humidity and high ambient temperatures are extremely stressful for birds. If the amount of heat produced by a bird is greater than the amount it loses, the bird's body temperature will increase. During hot weather birds will limit their daytime activity and will reduce feed consumption or stop eating. Feed consumption and digestion increases body temperature, and thus birds will decrease their feed intake to reduce their body heat production. Reductions in feed intake will cause decreased body weight gain, egg production, lower egg weight and poor shell quality in layers.
Reduction in feed intake and concurrent increase in water intake during summer will results in wet droppings.

7.1.1 SHED OREINTATION

- Orientation of house in an east-west direction to minimize exposure to direct to sunlight. Roof overhangs should be sufficient (3-5 ft) to protect the birds from strong sunrays.
- Poultry houses in tropics should have good roof insulation with the support of foggers and cooler systems. Thatching of roof with paddy straw or sugar cane leaves will reduce temperature inside the shed.
- In open sided houses, width of house will be a limiting factor so keep the optimum width (30-34 ft) for better cross ventilation.
- Increased air movement over the birds by air circulating fans.
- Avoid obstructing trees and buildings near the sheds.

7.1.2 WATER MANAGEMENT

Normally feed and water consumption ratio is 1:2 but when temperature goes up beyond 38^{o}C, this ratio may increase up to 1:3 or more.

- Supply of plenty of clean and cool water must be ensured during summer months.
- Use good quality sanitizers in water to control infections through water.
- Cover water tanks with wet gunny bags to avoid direct exposure to sun.
- Give Electrolytes, Glucose/Jaggery, vitamin C, Vitamin E , Vitamin A and Vit B complex in drinking water.
- Increase number of waterers and frequency of watering in deep litter brooding.
- Supply water lines should be properly burrowed or covered.
- In peak hot hours frequently flush out hot water from nipple lines.

7.1.3 FEED MANAGEMENT

- Change the diet according to consumption. Increase energy level in the feed by adding oil.
- Morning and evening feeding are recommended. Avoid feeding during peak hot hours.
- Increase vitamin C and vitamin E level in the feed. Addition of soda-bicarbonate will be helpful.

7.1.4 GENERAL MANAGEMENT

- Provide 1 ½ hour mid night light to encourage feed consumption.
- Follow recommended lighting programme.
- Overcrowding of birds should be avoided.
- Shifting, transportation, de-beaking and vaccination should be done during night or cool hours of the day.
- Provide proper cross ventilation.
- Fans (pedestal, ceiling or exhaust) may be fitted in sheds.
- Use foggers in the shed which could reduce the shed temperature up to 5-10^{o}C when humidity is not too high. Proper monitoring of timing for running of foggers, droplet size, cleaning of fogger nozzles, use of sanitized water, cleaning of fogger tank, litter condition etc. are necessary.
- Use of paint ,white lime etc practically reduces the shed temperature up to 2^{o}C
- In summer months provide wet gunny curtains on both sides of house or at least on wind side of the house.

7.2 WINTER MANAGEMENT

- During winter when temperature goes down below 10^{o} C, reduction in egg production and reduction in water intake may occurs. Therefore, the management of poultry during winter is an important concern for poultry farmer.
- During winter season feed consumption increases, change the diet according to feed consumption for optimum intake of nutrients to the birds.
- Poultry house should be designed in such a way to provide all the comfort required by birds during winter. Birds should be protected from chilled winds, for this gunny bags should be hanged at the places from where the cold air enters.
- Ammonia build up in the shed is avoided through proper ventilation during day time.
- Use proper bedding material for deep litter brooding.
- During winter season water consumption decreases. Provide warm and clean water.
- In ice falling areas, blockage of pipe is a big problem due to freezing of water during winter season. When temperature goes below 0°C routine inspection of pipe line should be done to avoid blockage of water line.

8. RECORD KEEPING

Accurate record keeping is back bone of every business. It is important tool in monitoring and evaluation process and also helps in efficient and proper management of the farm. Record keeping is a major management device for gathering and analyzing the facts for minimizing errors, reach operating perfections and plan for future activities to maximize the profit. Record keeping improves managerial ability of farm in-charge.

Advantages:

- Makes it possible to notice faults and rectify them.
- Helps in calculating accurate cost of production.
- Calculating profit and loss.
- Comparing production performance of particular flock with standards and previous flocks.
- Useful tool in future planning and growth.
- Records are valuable inputs for research.

Quality of records:

- Maintain records in proper register not on the loose papers.
- Computerize whole program and daily feed the data.
- Clear and detailed.
- Simple and easy to understand without any repetition.
- Reliable and relevant.

Type of records:

1. Flock Performance records
    - Egg production: Number of Eggs, Hen Day Production (HDP%) and Hen Housed Production HHP
    - Mortality (weekly and cumulative)
    - Feed consumption (daily, weekly and cumulative) and Feed efficiency (Feed per egg)
    - Water consumption
    - Egg weight
    - Body weight
2. Flock related records
    - Medication and vaccination records
    - Gas and Electricity consumption records
    - Post Mortem and laboratory records
    - Water tank and nipple line cleaning records
    - Feed rates
    - Eggs rate
3. General Farm records
    - Visitors register
    - Vehicle register
    - Supervisor and workers
    - Diesel consumption
4. Financial records
    - Expense for purchase of chicks, feed/feed ingredient, medicines, vaccines and other consumables.
    - Income from sale of eggs, culls, empty gunny bags and manure.

Financial records may be kept as per advice from your financial consultant.

9. NUTRITIONAL VALUE OF AN EGG

Chicken eggs have been considered as a wholesome and complete food because of its balanced nutrient profile suitable for human beings. 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-9.1 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 release26, 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 9.2: 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)

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.

10. Myths and Facts about an egg

1. 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)

2. 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)

3. 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.

4. 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.

5. 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.

Appendix-1

PERFORMANCE GOAL : BV380 COMMERCIAL STOCK

Liveability%			
	0 to 18 weeks of age	:	97 – 98
	19 to 72 weeks of age	:	95 – 96
Feed Intake			
	0 to 18 weeks of age	:	6.3 kg
	19 to 72 weeks of age	:	42.5 kg
Body Weight			
	At 18 weeks of age	:	1.5 kg
	At 31 weeks of age	:	1.8 kg
	At 72 weeks of age	:	1.95 kg
Sexual Maturity			
	Age at 50% rate of lay	:	21 – 22 week
	Age at 90 % rate of lay	:	23 – 24 week
Egg Production			
	Peak production	:	95+ %
	Egg production above 90 %	:	21+ weeks
	Total Hen Housed eggs for 72 weeks	:	308
Egg Weight			
	Egg weight at 32 weeks of age	:	59 g
	Egg weight at 52 weeks of age	:	62 g
	Egg weight at 72 weeks of age	:	64 g
Feed Conversion - Avg ME (Kcal/kg) 2520			
	Feed/egg for 19 – 72 weeks of age	:	139 g
Egg Characteristics			
	Shell colour	:	Uniform Brown
	Shell breaking strength	:	Ideal
Feather			
	Colour	:	Red
Temperament			
	Variety of management system	:	Docile

Appendix-2

REARING PERFORMANCE OF BV380 COMMERCIAL STOCK

Age in weeks	Livability %	Body weight(g)	Body weight Gain(g)	Feed Consumption per bird (g)		Types of Feed
				Per day	Cum.	
1	**99.5**	**65**	**-**	**11**	**77**	**Starter-1**
2	**99.3**	**120**	**55**	**18**	**203**	**Starter-1**
3	**99**	**180**	**60**	**24**	**371**	**Starter-1**
4	**98.8**	**240**	**60**	**30**	**581**	**Starter-1**
5	**98.6**	**330**	**90**	**35**	**826**	**Starter-2**
6	**98.4**	**420**	**90**	**39**	**1099**	**Starter-2**
7	**98.2**	**530**	**110**	**43**	**1400**	**Starter-2**
8	**98**	**650**	**120**	**47**	**1729**	**Starter-2**
9	**97.9**	**770**	**120**	**51**	**2086**	**Starter-2**
10	**97.8**	**880**	**110**	**55**	**2471**	**Developer**
11	**97.7**	**980**	**100**	**58**	**2877**	**Developer**
12	**97.6**	**1080**	**100**	**61**	**3304**	**Developer**
13	**97.5**	**1180**	**100**	**64**	**3752**	**Developer**
14	**97.4**	**1270**	**90**	**67**	**4221**	**Developer**
15	**97.3**	**1350**	**80**	**71**	**4718**	**Developer**
16	**97.2**	**1430**	**80**	**74**	**5236**	**Pre-lay**
17	**97.1**	**1500**	**70**	**77**	**5775**	**Pre-lay**
18	**97**	**1570**	**70**	**81**	**6342**	**Phase-1***

* Start phase-1 from 0.5% Hen Day Production

Note: Variation is possible due to differences in feed comosition, Lighting program and environment.

Appendix-3

PRODUCTION PERFORMANCE OBJECTIVES
BV380 COMMERCIAL STOCK

Age	Cum. Depletion%	% Hen Day Production	Hen Housed Production		Feed Consumption			Egg weight (g)
			Current	Cumulative	/Day(g)	per egg current	per egg Cumulative	
19	0.0	5.0	0.35	0.4	90	1800	1800	43.5
20	0.0	12.5	0.88	1.2	95	760	1057	45.5
21	0.0	35.6	2.49	3.7	98	275	533	48.0
22	0.1	64.2	4.49	8.2	100	156	327	50.5
23	0.1	83.7	5.85	14.1	105	125	243	52.5
24	0.1	92.2	6.45	20.5	110	119	204	54.0
25	0.1	94.0	6.57	27.1	111	118	183	55.5
26	0.2	95.0	6.64	33.7	112	118	170	56.5
27	0.2	95.0	6.64	40.4	114	120	162	57.5
28	0.2	95.0	6.64	47.0	115	121	156	58.5
29	0.3	95.0	6.63	53.6	115	121	152	59.0
30	0.3	95.0	6.63	60.3	115	121	149	59.3
31	0.3	95.0	6.63	66.9	115	121	146	59.5
32	0.4	95.0	6.62	73.5	116	122	144	59.6
33	0.4	95.0	6.62	80.1	116	122	142	59.7
34	0.5	94.6	6.59	86.7	116	123	140	59.8
35	0.5	94.2	6.56	93.3	116	123	139	59.9
36	0.6	93.8	6.53	99.8	117	125	138	60.1
37	0.6	93.4	6.50	106.3	117	125	137	60.2
38	0.7	93.0	6.46	112.8	117	126	137	60.4
39	0.7	92.6	6.44	119.2	117	126	136	60.5
40	0.8	92.2	6.40	125.6	117	127	136	60.7
41	0.9	91.7	6.36	132.0	117	128	135	60.8
42	1.0	91.2	6.32	138.3	117	128	135	61.0
43	1.1	90.7	6.28	144.6	117	129	135	61.1
44	1.2	90.2	6.24	150.8	117	130	135	61.3
45	1.3	89.7	6.20	157.0	117	130	134	61.4
46	1.4	89.2	6.16	163.2	117	131	134	61.6
47	1.5	88.7	6.12	169.3	117	132	134	61.7
48	1.6	88.2	6.08	175.4	117	133	134	61.9
49	1.7	87.7	6.03	181.4	118	135	134	62.0
50	1.8	87.2	5.99	187.4	118	135	134	62.2

V H GROUP

Appendix-3

PRODUCTION PERFORMANCE OBJECTIVES
BV380 COMMERCIAL STOCK

Age	Cum. Depletion%	% Hen Day Production	Hen Housed Production		Feed Consumption			Egg weight (g)
			Current	Cumulative	/Day(g)	per egg current	per egg Cumulative	
51	1.9	86.7	5.95	193.3	118	136	134	62.3
52	2.0	86.2	5.91	199.2	118	137	134	62.5
53	2.1	85.7	5.87	205.1	118	138	134	62.6
54	2.2	85.2	5.83	211.0	118	138	135	62.7
55	2.3	84.7	5.79	216.7	118	139	135	62.8
56	2.4	84.2	5.75	222.5	118	140	135	62.9
57	2.5	83.7	5.71	228.2	118	141	135	63.0
58	2.6	83.2	5.67	233.9	118	142	135	63.1
59	2.7	82.7	5.63	239.5	118	143	135	63.2
60	2.8	82.2	5.59	245.1	118	144	135	63.3
61	2.9	81.6	5.55	250.7	118	145	136	63.4
62	3.0	81.0	5.50	256.2	118	146	136	63.5
63	3.1	80.4	5.45	261.6	118	147	136	63.5
64	3.2	79.8	5.41	267.0	118	148	136	63.6
65	3.3	79.2	5.36	272.4	118	149	137	63.6
66	3.4	78.6	5.31	277.7	118	150	137	63.7
67	3.5	78.0	5.27	283.0	118	151	137	63.7
68	3.6	77.4	5.22	288.2	118	152	137	63.8
69	3.7	76.8	5.18	293.4	118	154	138	63.8
70	3.8	76.2	5.13	298.5	118	155	138	63.9
71	3.9	75.6	5.09	303.6	118	156	138	63.9
72	4.0	75.0	5.04	308.6	118	157	139	64.0

Note: These performance specifications are based on actual flock results obtained under good 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.

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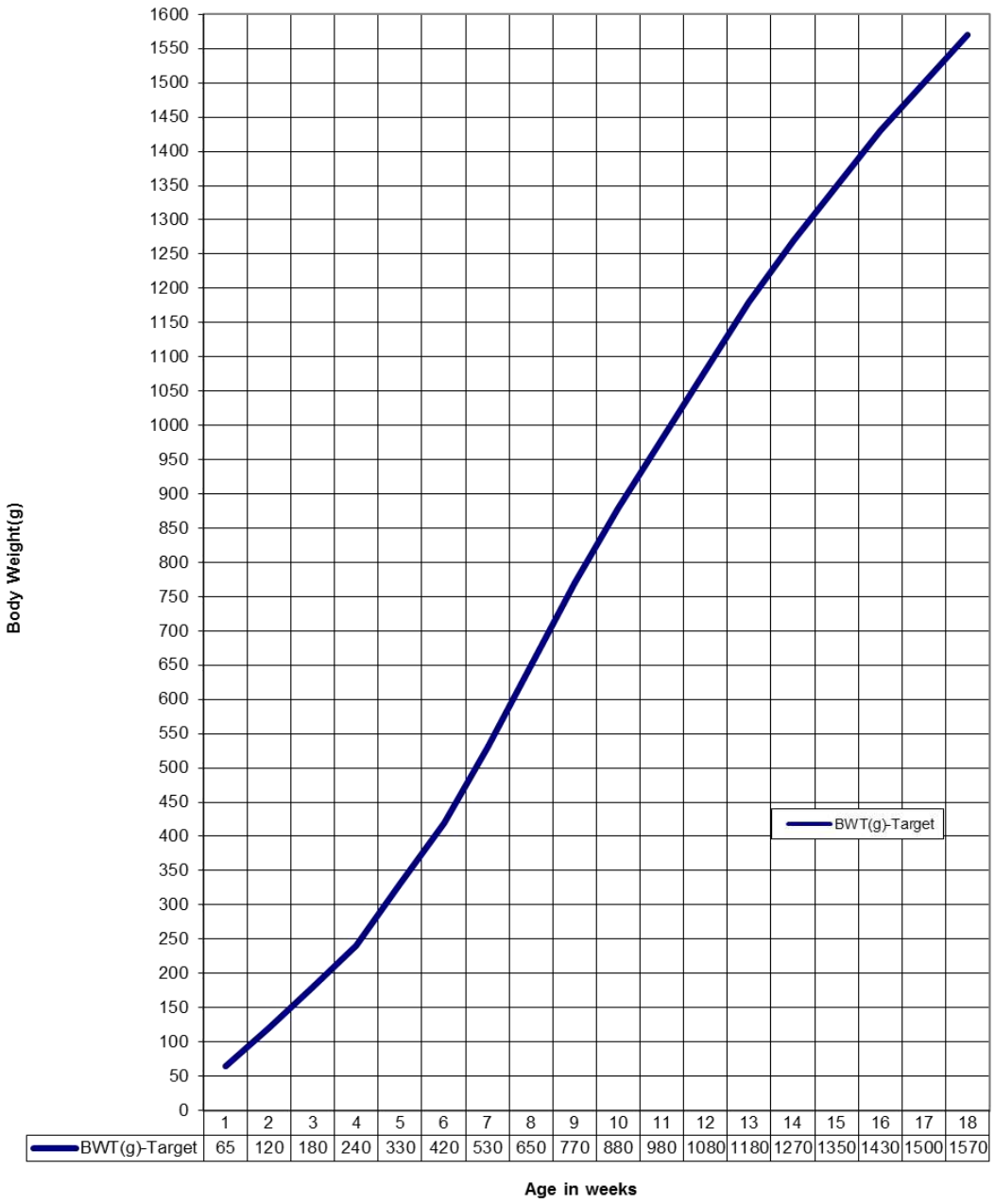
Appendix-4

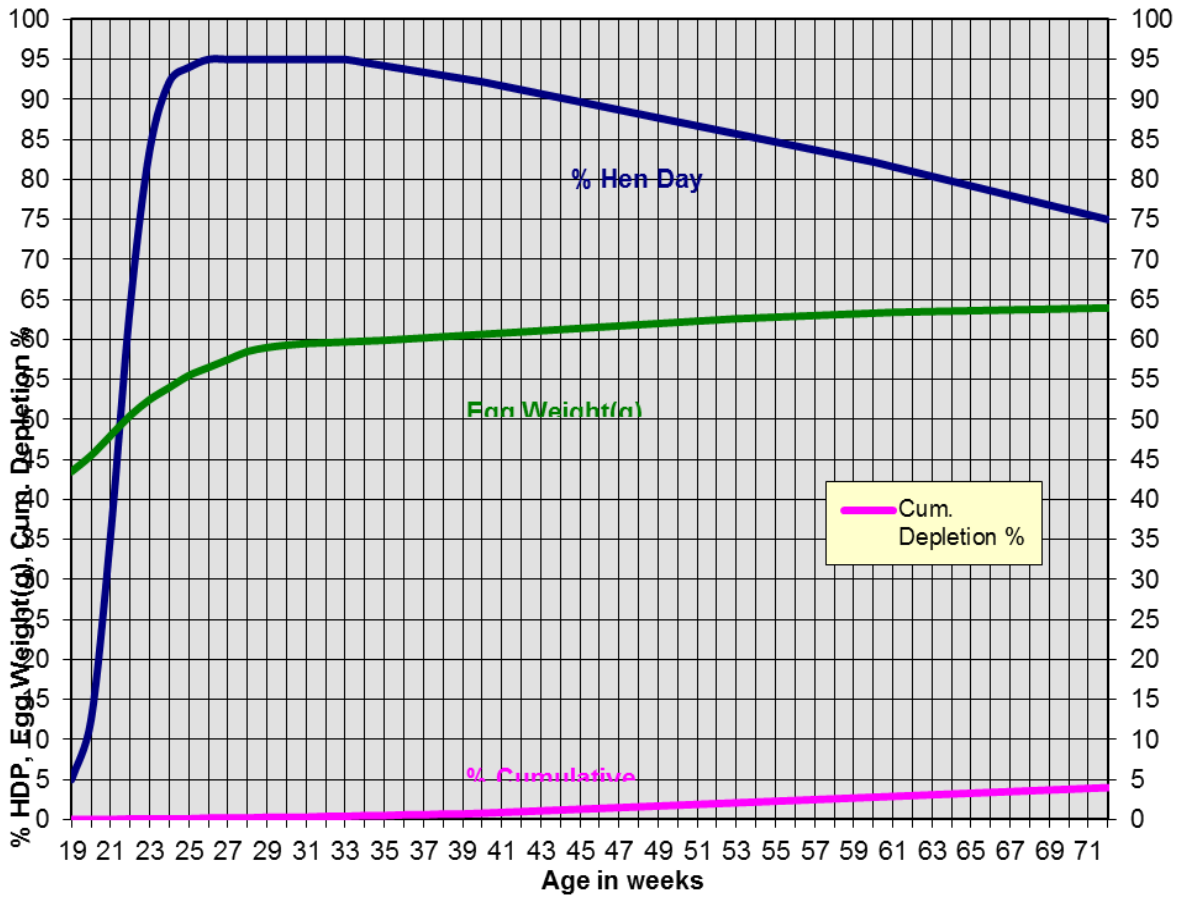
REARING BODY WEIGHT GRAPH: BV380 LAYERS



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
BWT(g)-Target	65	120	180	240	330	420	530	650	770	880	980	1080	1180	1270	1350	1430	1500	1570

Appendix-5

BV380 PERFORMANCE GRAPH



Appendix-6

NUTRIENT COMPOSITION OF COMMONLY USED FEED INGREDIENTS

Ingredients	ME kcal/kg	CP %	Ca %	Av.P. %	Na %	Cl %	L.A. %	Choline (g/kg)
Maize	3330	8.80	0.02	0.09	0.02	0.05	2.00	0.50
Jowar	3050	9.00	0.04	0.10	0.02	0.08	1.00	0.40
Bajra	3050	10.00	0.04	0.10	0.03	0.04	1.00	0.35
Broken rice	2750	8.00	0.04	0.10	0.05	0.07	0.45	0.60
Wheat	3050	10.75	0.05	0.12	0.04	0.06	0.45	0.70
Rice polish	2950	12.50	0.04	0.15	0.06	0.07	3.60	1.00
Rice bran, de-oiled	1750	14.00	0.07	0.18	0.04	0.06	0.40	1.00
Wheat bran	1800	14.60	0.17	0.40	0.04	0.07	1.70	1.10
Soybean refined oil	9000						52.00	
Soybean meal (46%)	2300	46.00	0.33	0.25	0.02	0.05	0.40	2.65
Groundnut meal (40%)	2400	40.00	0.19	0.19	0.06	0.03	0.55	1.50
Sunflower meal (28%)	1565	28.00	0.18	0.35	0.10	0.19	0.50	2.80
Rapeseed meal(36%)	1780	36.00	0.65	0.28	0.07	0.04	0.35	1.65
Fish meal (45%) *	1860	45.00	5.00	2.60	1.60	2.45	0.13	3.00
Meat and bone meal (45%) *	2050	45.00	10.0	5.00	0.60	0.70	0.35	1.65
Marble grit			36.00					
Limestone powder			36.00					
Dicalcium phosphate			24.00	16.00				
Monocalcium phosphate			16.00	19.00				
L-Lysine	3900	76.00			7.08	10.91		
D.L.Methionine	5000	58.00						
Threonine	4000	73.00						
Tryptophan	4000	84.00						
Salt					39.33	60.66		
Sodium bicarbonate					27.37			
Choline chloride (98 %)						24.50		755.00
Optiphos-Ds			1500	1000				

ME: Metabolizable energy, CP: Crude protein, Ca: Calcium, Av.P: Ava phosph, Na: Sodium, Cl: Chloride,LA: Linoleic A

***As a general rule when animal by-products cannot be guaranteed 100% free from contamination, DON'T USE.**

V H GROUP

Appendix-7

DIGESTIBLE AMINO ACID COMPOSITION OF COMMONLY USED INGREDIENTS

Ingredients	Lysine %	Methionine %	Cystine %	M+C %	Threonine %	Tryptophan %	Arginine %	Isoleucine %	Valine %
Maize	0.23	0.15	0.16	0.31	0.24	0.05	0.36	0.26	0.35
Jowar	0.17	0.12	0.11	0.24	0.21	0.08	0.26	0.23	0.30
Bajra	0.25	0.18	0.14	0.33	0.29	0.00	0.37	0.32	0.42
Broken rice	0.22	0.16	0.14	0.30	0.21	0.08	0.61	0.28	0.40
Wheat	0.29	0.18	0.25	0.44	0.31	0.13	0.50	0.34	0.47
Rice polish	0.42	0.18	0.20	0.35	0.34	0.13	0.85	0.29	0.47
Rice bran, de-oiled	0.48	0.23	0.17	0.40	0.40	0.15	0.90	0.39	0.58
Wheat bran	0.12	0.18	0.26	0.43	0.37	0.20	0.86	0.48	0.55
Soybean meal (46%)	2.47	0.53	0.52	1.04	1.46	0.52	3.12	1.80	1.85
Groundnut meal (40%)	1.17	0.36	0.51	0.88	1.08	0.38	4.36	1.80	2.38
Sunflower meal (28%)	0.70	0.51	0.27	0.77	0.68	0.78	3.07	0.98	1.16
Rapeseed meal(36%)	1.60	0.42	0.39	0.80	1.09	0.41	2.07	1.15	1.45
Fish meal (45%) *	2.75	1.12	0.33	1.39	1.55	0.38	2.27	1.65	1.94
Meat and bone meal (45%) *	1.40	0.36	0.18	0.54	0.78	0.10	2.43	0.74	1.17
L-Lysine	78.00								
D.L.Methionine		98.00		98.00					
Threonine					98.00				
Tryptophan						98.00			
M+C : Methionine + cystine									

Appendix-8

INGREDIENT SPECIFICATIONS (GUIDELINE FOR PURCHASE OF RAW MATERIAL)

Ingredients	Moisture %	CP %	CF%	EE%	AA / SS %	Ca%	Av.P %	FFA %
	Max	Min	Max	Min	Max	Min	Min	Max
Maize	12	8	4	3.0	0.4	NA	NA	NA
Jowar	12	8	4	3.0	1.0	NA	NA	NA
Bajra	12	9	2	3.0	2.8	NA	NA	NA
Wheat	12	12	2.7	1.5	1.0	NA	NA	NA
Broken rice	12	8	2.4	1.0	0.6	NA	NA	NA
Rice polish	10	12	6.0	16	2.8	NA	NA	2.0
Rice bran, de-oiled	12	14	13	0.5	3.0	NA	NA	NA
Soybean meal (46%)	12	46	6	1.0	1.5	NA	NA	NA
Groundnut meal (40%)	12	39	9	1.0	< 2	NA	NA	1.50
Sunflower meal (28%)	12	28	24	0.5	< 2	NA	NA	NA
Rapeseed meal(36%)	12	36	12.5	1.0	< 2	NA	NA	NA
Soybean refined oil	< 0.25	NA	NA	99	NA	NA	NA	< 0.1
Rice bran oil (crude)	<1	NA	NA	99	NA	NA	NA	2.0
Dicalcium phosphate	2	NA	NA	NA	< 1	24	16	NA
Monocalcium phosphate	2	NA	NA	NA	1.00	16	19	NA
Limestone powder	2	NA	NA	NA	2	36	NA	NA
Marble grit	NA	NA	NA	NA	2	36	NA	NA

CP: Crude protein, CF: Crude fiber, EE: Ether extract, AA: Acid insoluble ash / SS: Sand and silica, Ca: Calcium, AV.P: Available phosphorus, FFA: Free fatty acids.

Maintain moisture content for long storage of grain.

Grains should be free from insecticides, fungus (green / black), weevils, fowl /musty smell, sand /soil and damaged seeds.

Store all vitamins in air conditioned room.

Urease activity of soybean meal should be less than 0.3 mg nitrogen/Min @ 30 0c

Aflatoxin level should be less than 18 ppb (check for other toxins too)

Appendix-9

REARING NUTRIENT RECOMMENDATIONS

Item	Starter I	Starter II	Grower / Devloper	Prelay
Feed to a body weight of	230g	670g	1090g	Until 0.5 % HDP
Approximate age (weeks)	4	5--9	10--15	16--17
Metabolizable energy, kcal/kg	2860	2800	2685	2680
Crude protein, % Min	18.00	17.00	15.70	16.00
Calcium, % Min	1.20	1.20	1.20	2.50
Phosphorus (available), % Min	0.48	0.46	0.42	0.42
Dig.Lysine, % Min	0.89	0.81	0.68	0.70
Dig.Methionine+cystine, % Min	0.67	0.63	0.56	0.57
Dig.Threonine, % Min	0.59	0.54	0.46	0.48
Dig.Tryptophan, % Min	0.17	0.16	0.14	0.15
Dig.Arginine, % Min	1.02	0.93	0.78	0.81
Dig.Isoleucine, % Min	0.63	0.59	0.52	0.55
Dig.Valine, % Min	0.72	0.68	0.62	0.65
Sodium, % Min	0.20	0.18	0.18	0.18
Chloride, % Min - Max	0.21-0.24	0.18 -0.24	0.18 -0.24	0.17 - 0.24
Linoleic acid, % Min	1.20	1.20	1.20	1.20
Choline chloride (60%) g/kg Min (added)	1.875	1.875	1.875	1.875

Change diet at the recommended target body weight, the approximate age is a guide only.

Feed the prelay diet two weeks before the onset of egg production, when most pullets show some enlargement and reddening of their combs. Be prepared to change to the phase 1 diet at no later than 0.5% daily egg production, as the pre-lay diet does not contain sufficient calcium to sustain egg production.

50 % of added calcium carbonate should be 2 mm size in grower and developer diet to develop gizzard.

Max chloride should be 0.24%.

Suitable modifications are required as per environmental condition of the area and market requirements.

If there is any possibility of more than usual loss of vitamins in the process of feed manufacturing and or in specific disease conditions, the vitamins level may be increased as per the suggestions of the Nutritionist or disease expert.

V H GROUP

Appendix-10

BV380 COMMERCIAL STOCK NUTRIENT RECOMMENDATION:PHASE-1

Item	Phase -I (0.5 % HDP to 40 week)				
Feed consumption g/day per bird	**100**	**105**	**110**	**115**	**120**
Metabolizable energy, kcal/kg	2600	2575	2550	2475	2425
Crude protein, % Min	15.50	14.75	14.00	13.50	13.00
Calcium, % Min	4.20	4.05	3.90	3.75	3.60
Phosphorus (available), % Min	0.44	0.42	0.40	0.39	0.37
Dig.Lysine, % Min	0.67	0.64	0.61	0.58	0.56
Dig.Methionine+cystine, % Min	0.60	0.58	0.55	0.52	0.50
Dig.Threonine, % Min	0.52	0.50	0.48	0.45	0.44
Dig.Tryptophan, % Min	0.15	0.14	0.13	0.13	0.12
Dig.Arginine, % Min	0.77	0.74	0.70	0.67	0.64
Dig.Isoleucine, % Min	0.52	0.50	0.48	0.45	0.44
Dig.Valine, % Min	0.64	0.61	0.58	0.55	0.53
Sodium, % Min	0.18	0.17	0.17	0.16	0.15
Chloride, % (Min - Max)	0.18-0.24	0.17-0.23	0.16-0.22	0.15-0.21	0.15-0.20
Linoleic acid, % Min	1.20	1.15	1.10	1.05	1.00
Choline chloride (60%) g/kg Min (added)	1.25	1.20	1.15	1.10	1.00
Nutrient intake for respective feed consumption.					
Metabolizable energy, kcal/day	*260	*270	280	285	290
Crude protein, g/day	15.50	15.50	15.50	15.50	15.50
Calcium, g/day	4.20	4.25	4.29	4.31	4.32
Phosphorus (available), g/day	0.44	0.44	0.44	0.44	0.44
Dig. Lysine, g/day	0.670	0.672	0.671	0.667	0.672
Dig.Methionine+cystine, g/day	0.603	0.605	0.604	0.600	0.605
Dig. Threonine, g/day	0.523	0.524	0.523	0.520	0.524
Dig. Tryptophan, g/day	0.147	0.148	0.148	0.147	0.148
Dig. Arginine, g/day	0.771	0.773	0.772	0.767	0.773
Dig. Isoleucine, g/day	0.523	0.524	0.523	0.520	0.524
Dig. Valine, g/day	0.637	0.638	0.637	0.634	0.638
Sodium, g/day	0.18	0.18	0.18	0.18	0.18
Chloride, g/day (Min - Max)	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24
Linoleic acid, g/day	1.20	1.21	1.21	1.21	1.20

Optimal ratios to lysine	Lysine	M+C	Threonine.	Tryptophan	Arginine	Isoleucine	Valine
Phase I	100	90	78	22	115	78	95
Phase II	100	85	77	22	115	78	95

Appendix-11

BV380 COMMERCIAL STOCK NUTRIENT RECOMMENDATION:PHASE-II

Item	Phase II (above 41 week)						
Feed consumption g/day per bird	**100**	**105**	**110**	**115**	**120**		
Metabolizable energy, kcal/kg	2700	2625	2550	2475	2400		
Crude protein, % Min	15.00	14.30	13.70	13.00	12.50		
Calcium, % Min	4.35	4.20	4.00	3.90	3.80		
Phosphorus (available), % Min	0.42	0.40	0.39	0.37	0.35		
Dig.Lysine, % Min	0.65	0.62	0.59	0.57	0.54		
Dig.Methionine+cystine, % Min	0.55	0.53	0.50	0.48	0.46		
Dig.Threonine, % Min	0.50	0.48	0.45	0.44	0.42		
Dig.Tryptophan, % Min	0.14	0.14	0.13	0.13	0.12		
Dig.Arginine, % Min	0.75	0.71	0.68	0.66	0.62		
Dig.Isoleucine, % Min	0.51	0.48	0.46	0.44	0.42		
Dig.Valine, % Min	0.62	0.59	0.56	0.54	0.51		
Sodium, % Min	0.18	0.17	0.17	0.16	0.15		
Chloride, % (Min - Max)	0.18-0.24	0.17-0.23	0.16-0.22	0.15-0.21	0.15-0.20		
Linoleic acid, % Min	1.20	1.15	1.10	1.05	1.00		
Choline chloride (60%) g/kg Min (added)	1.25	1.20	1.15	1.10	1.00		
Nutrient intake for respective feed consumption.							
Metabolizable energy, kcal/day	*270	*275	280	285	290		
Crude protein, g/day	15.00	15.00	15.00	15.00	15.00		
Calcium, g/day	4.35	4.41	4.40	4.49	4.56		
Phosphorus (available), g/day	0.42	0.42	0.42	0.42	0.42		
Dig. Lysine, g/day	0.650	0.651	0.649	0.656	0.648		
Dig.Methionine+cystine, g/day	0.553	0.553	0.552	0.557	0.551		
Dig. Threonine, g/day	0.501	0.501	0.500	0.505	0.499		
Dig. Tryptophan, g/day	0.143	0.143	0.143	0.144	0.143		
Dig. Arginine, g/day	0.748	0.749	0.746	0.754	0.745		
Dig. Isoleucine, g/day	0.507	0.508	0.506	0.511	0.505		
Dig. Valine, g/day	0.618	0.618	0.617	0.623	0.616		
Sodium, g/day	0.18	0.18	0.18	0.18	0.18		
Chloride, g/day (Min - Max)	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24	0.18 - 0.24		
Linoleic acid, g/day	1.20	1.21	1.21	1.21	1.20		
Optimal ratios to lysine	Lysine	M+C	Threonine.	Tryptophan	Arginine	Isoleucine	Valine
Phase I	100	90	78	22	115	78	95
Phase II	100	85	77	22	115	78	95

Appendix-11A

NOTES ON LAYING PERIOD NUTRIENT RECOMMENDATION

1. **Nutrients will change accordingly when feeding differing energy value.**

2. **Suitable modifications are required as per environmental condition of the area and market requirements.**

3. **If there is any possibility of more than usual loss of vitamins in the process of feed manufacturing and or in specific disease conditions, the vitamins level may be increased as per the suggestions of the Nutritionist or disease expert.**

4. **Approximately 65 % of the added calcium carbonate should be in particle sizes of 2--3 mm**

5. **Phosphorus (available) requirement is with phytase. (phytase 0.1 %)**

6. **Max % of the Chloride should be 0.24 %.**

7. **Phase feeding and intake based formulations can be useful to control egg size, improve shell quality and for reducing feed cost.**

Appendix-12

ADDED VITAMIN AND TRACE MINERALS

Item	Rearing /Laying period
	In 1 kg complet diet
Vitamin A, IU	12500
Vitamin D3, IU	3300
Thiamin (B1),mg	4
Riboflavin (B2), mg	10
Pyridoxine (B6), mg	5
Cobalamine (B12), mcg	16
Niacin (B3), mg	33
Folic Acid (B9), mg	1
Biotin (B7), mcg	100
Vitamin K , mg	2
Vitamin E, mg	40
Pantothenic acid (B5),mg	15
Copper ,mg	22.8
Iron,mg	110.3
Manganese,mg	109.1
Selenium,mg	0.5
Iodine,mg	1.2
Zinc,mg	90.0

Appendix-13

DRINKING WATER STANDARDS

Parameter	Units	Maximum Permissible Limit
No. of Total Bacteria / ml	Nos.	Less than 50
No. of Coliforms/ml	Nos.	0
Total Dissolved Solids	mg/ltr	1000-2000
Total Hardness	**Mg/ltr**	**180**
pH		**6.5 – 7.5**
Cloudiness / Turbidity	**U**	**5**
Nitrates	**mg/ltr**	**25**
Nitrites	**mg/ltr**	**4**
Iron	**mg/ltr**	**0.3**
Magnesium	**mg/ltr**	**50**
Manganese	**mg/ltr**	**0.05**
Copper	**mg/ltr**	**0.5**
Zinc	**mg/ltr**	**1.5**
Calcium	**mg/ltr**	**60**
Sulphates	**mg/ltr**	**250**
Chlorides	**mg/ltr**	**200**
Fluoride	**mg/ltr**	**1.5**
Arsenic	**mg/ltr**	**0.05**
Sodium	**mg/ltr**	**50**
Salinity	ppm	Less than 1000

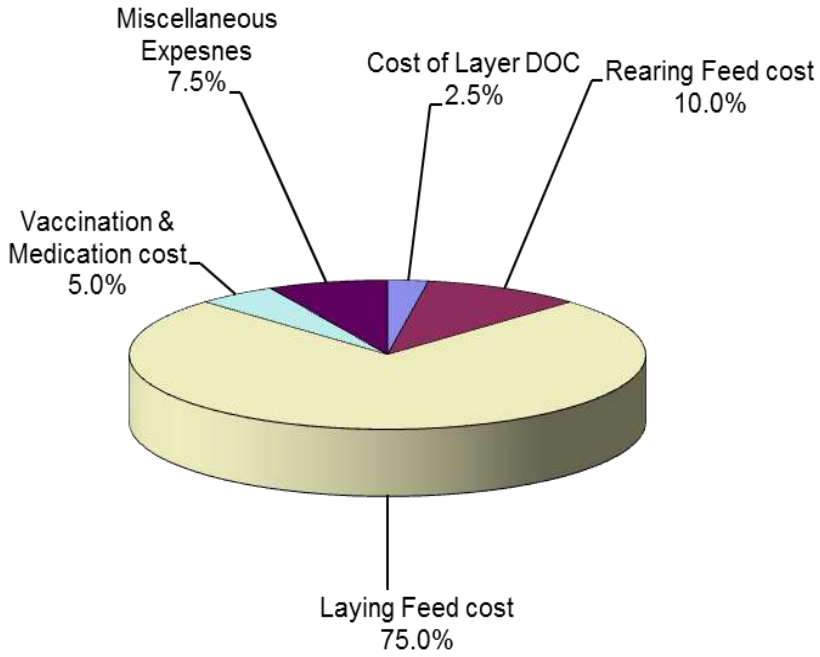
Appendix-14

SUNRISE, SUNSET AND DAY LENGTH

	Namakkal			Bangaluru			Hyderabad			Vijaywada			Pune			Anand			Chandigarh		
Month	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	6:41	18:13	11:32	6:46	18:12	11:26	6:50	18:02	11:12	6:39	17:54	11:15	7:09	18:17	11:08	7:21	18:15	10:54	7:21	17:43	10:22
Feb	6:38	18:25	11:47	6:42	18:26	11:44	6:43	18:18	11:35	6:34	18:10	11:36	7:02	18:35	11:33	7:10	18:35	11:25	7:04	18:10	11:06
March	6:25	18:28	12:03	6:27	18:30	12:03	6:25	18:26	12:01	6:16	18:17	12:01	6:43	18:44	12:01	6:47	18:47	12:00	6:34	18:31	11:57
April	6:06	18:29	12:23	6:07	18:32	12:25	6:01	18:32	12:31	5:53	18:23	12:30	6:18	18:51	12:33	6:19	18:59	12:40	5:56	18:50	12:54
May	5:55	18:33	12:38	5:54	18:38	12:44	5:44	18:41	12:57	5:37	18:31	12:54	6:01	19:01	13:00	5:58	19:11	13:13	5:28	19:10	13:42
June	5:54	18:41	12:47	5:54	18:47	12:53	5:42	18:52	13:10	5:35	18:41	13:06	5:57	19:12	13:15	5:53	19:24	13:31	5:19	19:27	14:08
July	6:02	18:45	12:43	6:01	18:50	12:49	5:50	18:54	13:04	5:43	18:44	13:01	6:06	19:14	13:08	6:02	19:26	13:24	5:30	19:27	13:57
August	6:07	18:37	12:30	6:08	18:41	12:33	5:59	18:42	12:43	5:51	18:33	12:42	6:16	19:02	12:46	6:15	19:10	12:55	5:49	19:06	13:17
September	6:07	18:18	12:11	6:09	18:21	12:12	6:04	18:19	12:15	5:56	18:10	12:14	6:22	18:37	12:15	6:25	18:42	12:17	6:07	18:29	12:22
October	6:07	18:00	11:53	6:10	18:01	11:51	6:09	17:55	11:46	6:00	17:47	11:47	6:28	18:12	11:44	6:35	18:13	11:38	6:25	17:52	11:27
November	6:13	17:50	11:37	6:18	17:50	11:32	6:21	17:40	11:19	6:11	17:33	11:22	6:40	17:57	11:17	6:51	17:55	11:04	6:49	17:26	10:37
December	6:28	17:56	11:28	6:34	17:56	11:22	6:38	17:44	11:06	6:28	17:37	11:09	6:58	18:00	11:02	7:10	17:56	10:46	7:12	17:23	10:11

Appendix-15

COMPONENT OF COST OF PRODUCTION



Considered price: DOC price=INR 28,

Appendix-16

REVENUE OF COMMERCIAL LAYERS

Trait	HHP	Profit per Birds (INR)	Cost per Egg (Paisa)
Increase of 1 INR per DOC	-	Reduce by 1	Increase by 0.25
Increase 1 % HDP	4.30	Increase by 13.7	Reduce by 3.3
Reduce 1% Laying Depletion	1.90	Increase by 6	Reduce by 1.4
1 kg more feed	-	Reduce by 17	Increase by 4.7
1 g more Feed/egg	-	Reduce by 6.2	Increase by 1.7
1 INR more feed rate	-	Reduce by 47	Increase by 12.9
1 g wastage of feed per day	-	Reduce by 7.4	Increase by 2