Feeding Management of Layer

Chick feeding

Starter feed are fed to newly hatched chicks until 8 weeks. Starter diets are formulated to give proper nutrition to fast growing baby chicken. Chicks require a ration that can provide the nutrients needed for rapid growth and feather development. Chick rations are relatively high in energy, protein and the vitamins and minerals required for growth and development.

Grower feeding

After 8 weeks of age, the grower feed is used in place of the starter feed upto 20 weeks. After about 14 weeks of age, the grower feed can be replaced with developer feed if it becomes available for pullets, which prepare young chicken for egg production. Feeding management for growers or pullets aims to maintain a growth rate that would lead the pullets in reaching sexual maturity at the desired age and weight and to avoid obesity. Grower ration has lower energy and protein levels than chick rations. Sometimes, a pre-lay ration with increased level of calcium is recommended for feeding 2-3 weeks before the bird begins to lay eggs. Once the chicks are fully feathered their energy requirements are reduced.

Restricted feeding is sometimes practised for growers. The restricted feeding means reduction in feed intake or nutrient intake, particularly energy and protein, below the normal feed intake or nutrients requirements, respectively. This is done during the growing periods of layers (14-20 weeks). The reduction is done either by limiting the total amount of feed at 85-90% level of normal intake or diluting the feed with low nutrient dense feed ingredients so that there is reduction in energy and protein content of feed to 85-90% of normal level. The dilution can be done by adding fibrous materials of low nutrient density, such as deoiled rice bran, rice polish, wheat bran, etc.

The reasons for restricted feeding are:

1. To avoid fattening of birds as the obesity leads to poor egg production.
2. Secondly, the restricted feeding causes 5-10 days delay in sexual maturity and thereby reducing in the number of small eggs laid at the start of production.
3. Restricted feeding is also being done in broiler breeder to check the weight gain of breeder because excess weight of breeder affects the fertility and egg production.

Layer feeding

Layer ration is designed to optimize egg production. This can be in terms of egg numbers, egg size or egg mass. The feed intakes of layer birds are lower as compared to broilers because of lower body size and lower growth rate. Once chicken have started laying eggs, layer feed is used. Layer feeds are formulated for chicken that are laying table eggs. Layer feed (BIS, 2007) contain higher energy and protein than grower feed. Compared to grower feed it also contains extra amount of calcium so the chicken can lay eggs with strong shells. This feed is fed from about 20 weeks of age or when the first egg is laid, whichever occurs first. Feeding programmeme that use only single feed during the entire lying periods is simple and easy to

manage but costly. Therefore BIS (2007) recommends phase feeding programmeme in two phases: phase-I and phase-II. Phase feeding is the feeding layer birds in different phases to adjust their nutrient intake in accordance with the rate of egg production. Phase-I continues from 21-45 weeks and phase-II from 46-72 weeks. Layer feed for phase-II contains less concentration of nutrients, such as energy, protein and amino acids, compared to that of phase-I, because feed intake increases with the advance of age and increase in body weight. Phase feeding controls the feed intake and body weight of layers and thereby also size of eggs. Thus it minimizes the production cost. The concept of phase feeding was introduced by Dr. G.F. Combs in 1960.

As per BIS (2007) phase feeding of layers is as follows:

1. Phase-I: This phase is most critical period starting from 20 to 45 week of age. In this phase egg production increases from zero to peak (90-96% production). Egg size is increased from 40g to 56g and the body weight of birds is also increased. So in this phase birds require optimum amount of nutrients.
2. Phase-II: From the age of 46 weeks, when bird's egg productivitaminy comes down to around 90%, the protein level is changed (16% CP) according to the level of production to reduce the cost of production.

It is also further suggested that after reduction of egg production to 75%, crude protein level may be reduced to15%.

Phase feeding refers essentially to reduction in the protein and amino acid levels of the diet as the bird progresses through a laying cycle. The concept of phase feeding is based on the fact that as birds get older their feed intake increases, while their egg production decreases. For this reason, it should be economical to reduce the nutrient concentration of the diet. At this time, it is pertinent to consider a conventional egg production curve of a layer, and superimpose both egg weight and daily egg mass output. If nutrient density is to be reduced, this should not occur immediately after peak egg numbers, but rather after peak egg mass has been achieved. There are two reasons for reducing the level of dietary protein and amino acids during the latter stages of egg production, first, to reduce feed costs and secondly, to reduce egg size. The advantages of the first point are readily apparent if protein costs are high, but the advantages of the second point are not so easily defined and will vary depending upon the price of eggs. When a producer is being paid a premium for extra large and jumbo eggs, there is no advantage to using a phase feeding programme unless egg shell quality is a problem.

It is difficult to give specific recommendations as to the decrease in dietary protein level that can be made to reduce egg size without decreasing the level of production. The appropriate reduction in protein level will depend on the season of the year (effect of temperature on feed consumption), age and production of the bird, and energy level of the diet. Hence, it is necessary that every flock be considered on an individual basis before a decision is made to reduce the level of dietary protein. As a guide, it is recommended that protein intake be reduced from 17g/day to 16g/day after the birds have dropped to 80% production and to 15g/day after they have dropped to 70% production. With an average feed intake of 100 g/day, this would be equivalent to diets containing 17, 16 and 15% protein. It must be stressed that these values

should be used only as a guide after all other factors have been properly considered. If a reduction in the level of protein is made and egg production drops, then the decrease in intake has been too severe and it should be immediately increased. If, on the other hand, production is held constant and egg size is not reduced then the decrease in protein intake has not been severe enough and it can be reduced still further. The amino acid to be considered in this exercise is methionine, since this is the amino acid that has the greatest effect on egg size. Phase feeding of phosphorus has also been recommended as a method of halting the decline in shell quality often seen with older birds. Using this technique, available phosphorus levels may be reduced from approximately 0.4% at peak production to slightly less than 0.3% at the end of lay. Table 10 shows an example of phase feeding of protein, methionine and phosphorus, related to egg production, and independent of feed intake.

A major criticism of phase feeding is that birds do not actually lay "percentages" of an egg. For example, if a flock of birds is producing at 75% production, does this mean that 100% of the flock is laying at 75% or is 75% of the flock laying at 100% production? If the latter is true, then the concept of phase feeding may be harmful. If a bird lays an egg on a specific day, it can be argued that its production is 100% for that day, and so its nutrient requirements are the same regardless of the age of bird. Alternatively, it can be argued that many of the nutrients in an egg, and especially the yolk, accumulate over a number of days, and so this concept of 100% production, regardless of age, is misleading.

Advocates of phase feeding indicate that birds can be successfully managed by reducing protein/amino acid contents of the diet-others suggest that nutrient specifications are too high to start with initially, and that phase feeding merely accomplishes normalization of diet in relation to requirement. The bottom line is that environmental and management conditions vary from flock to flock, and certainly from season to season within a flock. For this reason, the basis of phase feeding must be an accurate assessment of the nutrient intake relative to requirement for production, growth and maintenance.

Molting hen

After 8 to 12 months of egg production, some flocks are molted as a means of extending the period of production. A combination of feed, water, and light restriction is usually used to stop egg production and cause a rest, which may last from 3 to 6 weeks. A rest can also be induced by free-choice feeding of a diet containing a deficiency or excess of a specific nutrient. Examples of nutrients used to induce molt include excess iodine, excess zinc, and sodium chloride deficiency. After the rest, egg production can be initiated by stimulatory lighting. Little research information is available on the nutrient requirements of molted hens; therefore NRC (1994) has assumed that requirements are similar to those of hens during the first cycle of production.

Calcium for layer

The major mineral required for egg shell quality is calcium. Thin egg shells are observed when calcium, phosphorus, zinc and vitamin D_3 are not provided in diets at adequate levels. Layers need 3 – 3.5 gram of calcium per day from first egg throughout the laying period. The

recommended strategy is to feed a constant, modest level of calcium in the feed and to use calcium grit (e.g. limestone or oyster shell) to provide the additional requirement. After peak production the feed intake is gradually reduced and by increasing the amount of calcium grit, the total amount of calcium per day from feed and grit can be secured. The metabolic requirement for calcium occurs mainly during the night when the egg shell is formed. Feeding the additional grit in the afternoon can provide the bird with calcium during the night when it is needed most. Laying hens should have some portion of calcium available free-choice while calcium is being added to feed.

Moulting is the physiological process of the bird shedding and re-growing feathers to rejuvenate its body to start laying. Moulting occurs naturally in the wild, as seasonal daylight shortens and females stop laying eggs. Laying hens are generally moulted once or twice during their productive lives.

When laying birds are kept fasting along with reduced amount of daylight and low amount of water birds lose a portion of their body weight, which is called forced moulting. Moulting usually does not affect egg size, but allows for an improved egg laying rate, improved shell quality, and increased albumin height. When daylight length is increased hens begin laying eggs again as normal productivitaminy. Forced moulting increases the laying periods of birds and is practiced when the birds' egg production is low and egg price is also low.

Dietary manipulation for improvement of egg quality

Nutritional quality of eggs is also affected by type of feed consumed by birds. Quality of feed can be enhanced by following dietary manipulation.

1. Egg yolk is considered one of the richest sources of cholesterol in human diet. Normal cholesterol content of eggs (about 200-250 mg) and blood (around 150mg %) in chicken has been found to vary quite considerably. The cholesterol content of chicken egg can be reduced up to 25 % through the use of additives, dietary fibre and polyunsaturated fatty acid supplementation.
2. Omega-3 fatty acids have cardio protective and other beneficial effects. Poultry nutritionists have started research to incorporate more of these fatty acids in the egg and have succeeded in developing such an egg called Omega-3 enriched 'designer egg'. This egg can be called as the 'diet egg' or the 'functional egg'.
3. Diet eggs can have a high percentage of Vitamin E, an antioxidant, which prevents oxidation of cholesterol and therefore its ill effects. These eggs may also contain 600 mg of Omega-3 fatty acids. Omega-3 fatty acids help to reduce cholesterol triglycerides, clog formation, tumour growth and improved immunity.
4. In order to improve the quality of these eggs further selenium, carotenoid pigments, etc. are also being increased in these eggs.

Table 4.12: Expected performance of commercial layer flocks (BIS, 2007)

Sl.No.	Age in weeks	Production %	Egg/HH(Week)	Egg (HH)	Daily Feed intake(g)
1	19	5	0.35	0.35	75
2	20	15	1.05	1.40	62
3	21	38	2.66	4.06	90
4	22	64	4.48	8.54	93
5	23	83	5.81	14.34	96
6	24	80	5.6	20.55	102
7	25	92	6.44	26.99	104
8	26	94	6.58	33.56	106
9	27	94	6.58	40.12	108
10	28	95	6.65	46.75	108
11	29	96	6.72	53.44	109
12	30	97	6.79	60.20	111
13	31	97	6.79	66.96	111
14	32	97	6.79	73.20	115
15	33	96	6.72	80.40	115
16	34	96	6.72	87.07	115
17	35	96	6.72	93.73	114
18	36	96	6.72	100.39	114
19	37	95	6.65	106.98	114
20	38	95	6.65	113.55	113
21	39	95	6.65	120.13	113
22	40	95	6.65	126.69	113
23	41	94	6.58	133.18	113
24	42	94	6.58	139.66	113
25	43	94	6.58	146.13	113
26	44	93	6.51	152.53	113
27	45	93	6.51	158.92	113
28	46	93	6.51	165.31	113
29	47	93	6.51	171.69	113
30	48	93	6.51	178.06	113
31	49	92	6.44	184.36	113
32	50	92	6.44	190.65	112
33	51	91	6.37	196.87	112
34	52	90	6.3	203.01	112
35	53	89	6.23	209.06	112
36	54	89	6.23	215.15	112

37	55	89	6.23	221.21	112
38	56	89	6.23	227.27	112
39	57	89	6.23	233.33	112
40	58	86	6.02	239.31	112
41	59	89	6.23	245.29	112
42	60	60	4.2	251.26	112
43	61	68	4.76	257.22	110
44	62	87	6.09	263.12	110
45	63	87	6.09	269.02	110
46	64	86	6.02	274.84	110
47	65	86	6.02	280.65	110
48	66	86	6.02	285.46	110
49	67	85	5.95	292.20	110
50	68	84	5.88	297.86	110
51	69	84	5.88	303.52	110
52	70	83	5.81	309.11	110
53	71	82	5.74	314.63	110
54	72	81	5.67	320.07	110

Feeding of Breeding Stock

A breeder diet should have proper level of energy and protein. Providing adequate vitamins in a breeding ration is very important. Vitamins may account for about 4% of the cost of a breeder feed. Deficiencies of various trace elements and vitamins may lead to reduced hatchability and poor chick quality. The amount of feed required daily depends on the body size, the rate of production and atmospheric temperature. Breeder stocks must be prevented from becoming fatty to maintain their optimum reproductive performances. Both male and female breeders should be placed on a breeder diet five to six weeks before saving hatching eggs.

Male weight and body condition are controlled by adjusting feed quantity so that a slow constant increase in weight (30g/week) is achieved as the male grows older. After 30 weeks of age, male's weekly body weight gain should be approximately 30 grams when averaged over a three week period. Normally an adult cock consumes 130-160 grams feed daily. Both underfeeding and overfeeding of males are possible, and can cause problems. Underfeeding is more common after 40 weeks of age. Cocks may appear dull and listless, having excess feather loss, reduced mating ability and vent colour may become paler and overall there may be reduced fertility. Overfeeding of cocks leads to excessive breast development and excessive weight which can lead to injury of hen while mating, more stress on the cock's joints and foot pads and reduced sex drive.

Feeding of Back Yard Poultry

The backyard poultry farming is more beneficial to small, marginal farmers, land less labourers, tribal and backward class peoples. Backyard poultry farming generates small income for house hold requirement.

Backyard poultry usually feed on household wastes, farm products and green vegetation, besides free scavenging for waste grains and insects. These birds can perform well with diets high in crude fibre. It has better feed efficiency even with diets containing low energy and protein diets. During the process of scavenging on grass fields these birds have an access to insects, white ants, green grass, grass seeds, waste grains etc., thereby the supplemental feed requirement is much less than those reared under intensive poultry farming.

Feed supplementation in the form of scratch is usually given in the morning and evening to develop habit to reach owner's place for laying eggs and for night shelter. Depending on the availability of free range area and also the intensity of vegetation growth, the requirement of supplemental feed varies between 25-50 g/bird/day. Backyard birds can also perform well on whole grain feeding under scavenging conditions. For better shell quality, shell grit or limestone needs to be supplemented at the rate of 5-7 g/bird/day during laying period. However, colour of egg yolk or even meat of the birds reared in this system becomes bright yellow or orange as birds can get good amount of carotenoids from scavenging.

Birds that get all their nutrients from scavenging may eat an excess of protein, if insects, worms, larvae etc. are available. Hence supplemental feeding of energy in the form of carbohydrate (cereal grains, etc.) is needed.Fenced or backyard poultry fed with household or garden waste may lack both energy and protein for good growth or egg production. In such cases supplementation with energy sources, protein sources and micronutrients are required.

Disease and Condition in Poultry due to Imbalance in Nutrition

Cannibalism

It occurs in flocks due to deficiency of common salt of sodium and also due to deficiency of crude fibre. If fibre free diet which contain less than 3% crude fibre is fed to chicken cannibalism is more observed. Methionine deficiency also result cannibalism. However, overall deficiency of feed or nutrient(s) for some days can produce cannibalism in chicken.

Fatty liver and kidney syndrome (FLKS)

The deficiency of biotin can leads to this condition in young broilers. This condition is most commonly seen in 2-4 week old bird fed wheat based diet because wheat is deficient in biotin. Pyruvate carboxylase enzyme is biotin dependent and due to its deficiency death is caused by hypoglycaemia due to failure of hepatic gluconeogenesis. This affects kidneys because kidneys are vitaminal organs having high energy demand and are affected adversely leading to condition called as FLKS.

Fatty liver haemorrhagic syndrome (FLHS)

This condition is accompanied by excessive accumulation of fat in the liver. The main reason is low protein and high energy ration. Amino acid deficiency or their imbalance is also responsible for this condition. Deficiency of lipotrophic factors is responsible. Certain mould toxins have also been reported as a cause of this condition.

The lesions are excessive fat deposition in the liver with haemorrhage. This condition may be prevented by increasing the level (1-2%) of dietary protein supplementation with 50 g of $CuSO_4$, 500 g of choline, 3 mg of Vitamin B_{12}, 500 I.U of Vitamin E and 500 g of methionine per 100 kg of ration.

Cage layer fatigue and bone breakage in layer

High producing laying hens maintained in cages, sometimes show paralysis at peak egg production. The condition is caused by breakage of the vertebrae which subsequently affects the spinal cord .The reason is an impaired calcium mobilisation due to high output of Ca through the egg shell. This condition is more common in caged birds and the birds reared on deep litter system are rarely affected. It is because of the deficiency of exercise and the effects which influence the metabolism of Ca. The condition can be cured or prevented by increasing birds' exercise, reducing deposition of fat in the body and improving calcium metabolism by birds.

Salt poisoning

The requirement of salt is very less in poultry as compared to other animals. The excess of salt either in water or in feed is toxic .The symptom of salt poisoning are watery drops, increased water intake, muscular weakness, convulsion and death. On post mortem examination severe congestion and haemorrhages are observed in elementary canal, liver, lungs, kidney and muscles. The level of salt should not exceed 0.5% in ration and 3000 ppm in drinking water.

Stress

When reactive oxygen species (ROS) in the body deforms the lipid layers in cell membranes and decreases the function of membranes. It increases the susceptibility to infection in birds. The condition is called oxidative stress.

Commercial broilers are subjected to stress and this stress decreases the lymphocytes number and increase birds' susceptibility to diseases. ROS which are produced in body by normal metabolic process are responsible for distraction of lipid layer in cell membrane thus causes death of the cell. When antioxidants like vitamin E, vitamin C, vitamin A, carotenoids, Se, Cu, Zn and Mn is supplemented the ROS are neutralised by their antioxidant effects that reduce the free radical damage to the cells and help in improving immunity, growth and production. It has been reported that the broilers subjected to stress are benefited by inclusion of vitamin E at higher concentration in diet. Vitamin E level of 20-50 mg/kg feed has been found effective. It also helps in preventing the rancidity of fat in the feed. When poultry feed containing oil, fat, rice polish or rice bran which are rich in unsaturated fatty acids are stored for long period the unsaturated fatty acids (UFA) are oxidized by oxidative rancidity. To protect UFA from destruction vitamin E or other antioxidants are necessary to be added in feed. Thus vitamin E may be used up to protect feed from rancidity; so vitamin E content is reduced in feed which is responsible for deficiency of vitamin E in poultry. To prevent such conditions, optimum level of vitamin E should be included in poultry ration.

Disease and Condition due to Vitamin Deficiency

Vitamin deficiencies are most commonly due to inadvertent omission of a vitamin premix from the birds' diet. Multiple signs are therefore seen, although in general, problems with deficiencies of the B vitamins appear first. Because there are some stores of fat-soluble vitamins in the body, it often takes longer for these deficiencies to affect the bird.

Treatment and prevention rely on an adequate dietary supply, usually microencapsulated in gelatin or starch along with an antioxidant. Vitamin destruction in feeds is a factor of time, temperature, and humidity. For most feeds, vitamin efficiency is little affected over 2-month storage within mixed feed.