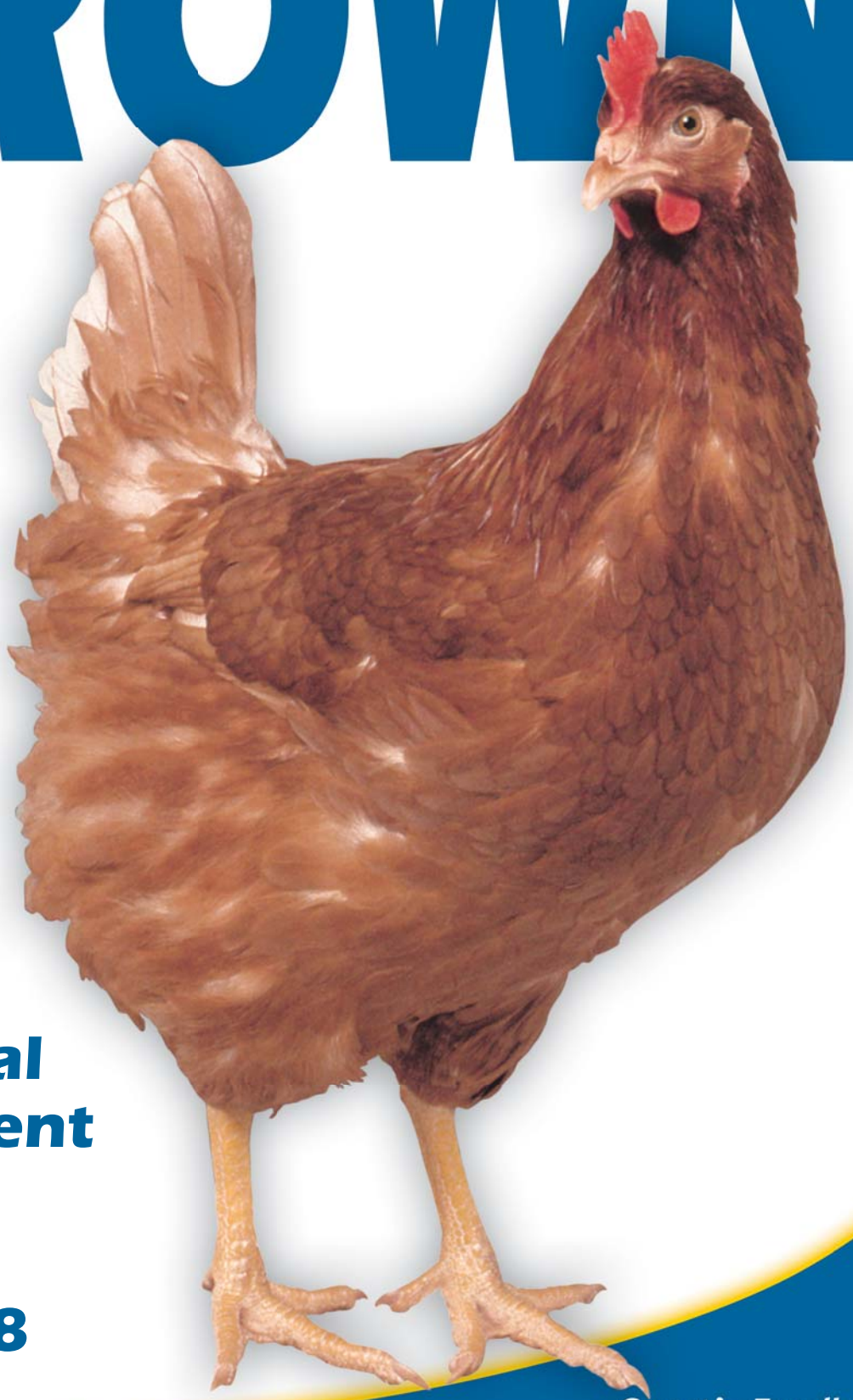
Hy-Line® VARIETY

BROWN



Commercial Management Guide

2006-2008

Genetic Excellence®

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Hy-Line International is committed to providing proper care for its flocks. Hy-Line subscribes to the husbandry practices for egg laying chickens as outlined by the United Egg Producers (UEP). We believe that it is our obligation to provide good management and husbandry practices for poultry, including proper housing, feeding, watering, lighting, ventilation, sanitation and vaccination programs to protect the health and welfare of all our flocks.

Capabilities of the Hy-Line® Variety Brown

GROWING PERIOD (to 17 weeks):

Livability	96-98%
Feed Consumed	6.0 Kg (13.2 Lbs.)
Body Weight at 17 Weeks	1.47 Kg (3.24 Lbs.)

LAYING PERIOD (to 80 weeks)

Percent Peak	94-96%
Hen-Day Eggs:	
To 60 Weeks	253
To 74 Weeks	331
To 80 Weeks	362
Hen-Housed Eggs:	
To 60 Weeks	250
To 74 Weeks	326
To 80 Weeks	355
Livability to 80 Weeks	96%
Days to 50% Production (from hatch)	145 days
Egg Weight at 32 Weeks	62.7 g/Egg (49.8 Lbs./Case)
Egg Weight at 70 Weeks	66.9 g/Egg (53.1 Lbs./Case)
Total Egg Mass Per Hen-Day	
18-74 Weeks	21.1 Kg (46.6 Lbs.)
18-80 Weeks	23.2 Kg (51.1 Lbs.)
Body Weight at 70 Weeks	1.94 Kg (4.27 Lbs.)
Freedom From Egg Inclusions	Excellent
Shell Color	Uniform, Dark Brown
Shell Strength	Excellent
Haugh Units at 70 Weeks	80
Average Daily Feed Consumption (18-80 weeks)	109 Grams/Bird/Day (24.0 Lbs./100 Birds/Day)
Kg of Feed per Kg of Eggs (21-74 weeks)	1.96
Feed per Dozen Eggs (21-74 weeks)	1.50 Kg (3.31 Lbs.)
Feather Color	Red with white underfeathers
Skin Color	Yellow
Condition of Droppings	Dry

Figures contained in this management guide have been compiled from extensive commercial flock records gathered from all parts of the world to the date of printing of this guide. Further management suggestions listed in this booklet are combined principles taken from industry technical literature and field experience with this variety. Neither the performance figures nor management suggestions are in any way a guarantee of performance. Productivity of a commercial flock of any variety layer will vary according to environment and disease conditions.

Chick Management

Hy-Line Brown chicks adapt equally well to floor and cage brooding systems. They require no special hatchery services except vaccination against Marek's disease.

General Recommendations

1. Prior to delivery of chicks:

- **a.** Clean and disinfect cages or floor brooding area. Clean the building interior, attached service areas and equipment.
- **b.** Check to make sure equipment is working properly and is adjusted to the right height.
- **c.** Remove all old feed from bins, hoppers, and troughs. Disinfect and allow to dry before new feed is delivered.
- **d.** Place rat/mouse poison where it will not be consumed by the chicks.

2. One day before delivery:

- **a.** Set heating system at 35–37°C (95–99°F.) at chick level.
- **b.** Check water system. Adjust to proper height for chicks. Disinfect and flush water lines.

3. On delivery day:

- **a.** Have waterers full or water system in operation. Check brooder temperatures.
- **b.** As chicks are placed, trigger water cups or nipples to encourage drinking.
- **c.** When nipple drinkers are used, reduce the water pressure so birds can see the drop of water hanging on the drinker.
- **d.** Feed should be placed on paper in cage. Operate feeders at highest feed level.
- **e.** Keep lights at high intensity 20–22 hours per day for first week.

Growing Period Management

The first 17 weeks of a pullet's life are critical. Good management during this period can assure that she reaches the laying house ready to deliver her bred-in performance potential. Mistakes made during the first 17 weeks generally cannot be corrected in the laying house.

General Recommendations

1. Grow pullets in strict isolation from older birds. Maintain good sanitation. As much as possible, plan work routines so that disease organisms cannot be carried from older birds to the growing pullets.

2. During the first six weeks, operate feeders to provide feed twice daily, or more often. After six weeks, check feed consumption and body weights against the charts on pages 12 & 13. (Weigh 100 pullets to get a meaningful average.)

3. Check water availability in each cage row daily. Check for and repair leaks. Raise waterers as the birds grow (nipples higher than the birds' heads; cups or troughs level with their backs).

4. Plan and follow a vaccination schedule to fit your area.

5. Remove mortality daily and dispose of properly. Examine for causes of excessive mortality.

6. Three days before moving pullets to the laying house, begin using water-soluble vitamins and electrolytes in the drinking water. Continue for three days after housing. This helps minimize the stress of moving. Gentle handling will pay big dividends.

Growing Space Recommendations

CAGE		FLOOR	
Floor Space:	350 sq cm (54 sq. in.)	**Floor Space:**	1115 sq cm (1.2 sq. ft.)
Feeder Space:	8.0 cm/bird (3"/bird)	**Feeder Space:**	8.0 cm/bird (3"/bird) 1 pan/20 birds
Water Space:		**Water Space:**	
Trough:	3.0 cm/bird (1.2"/bird)	Trough:	3.0 cm/bird (1.2"/bird)
Cups/Nipples:	1 per 8 birds	Cups/Nipples:	1 per 8 birds
Fountains:	—	Fountains:	1 per 50 birds

Cage Brooding

Before the birds arrive, prepare the house as follows:

1. Put nonskid paper on the bottom of the cage. This paper may disintegrate and fall through the cage bottom or it should be removed at beak trimming time (10 days).
2. Start the heating system 24 hours before the birds arrive. Adjust the temperature to 35–37°C (95–99°F.).
3. Keep the relative humidity at 50% minimum. In cage brooding, adequate humidity is very important.

Temperature Management

In a cage or warm room brooding system, reduce the temperature 3°C (5°F.) per week from 36°C (97°F.) until 21°C (70°F.) is reached. Look for signs of overheating (panting and drowsiness) or chilling (huddling) and make appropriate adjustments. Heat control is more critical in cage brooding because the chicks cannot move to find their comfort zone.

Maintain adequate humidity if you brood in cages. Relative humidity for cage brooding must be maintained at 40-60%. If necessary, sprinkle water on the walks or floors to increase humidity.

Floor Brooding

Twenty-four hours before delivery of the chicks, prepare the house as follows:

1. Place a brooder ring around each brooder unit.
2. Adjust brooder temperature to 35°C (95°F.).
3. Fill jug waterers — two 4-liter (one gallon) waterers per 100 chicks.
4. Eliminate all drafts from the house.

Temperature Management

When using a gas fired hover, reduce the temperature under the hover by 3°C (5°F.) per week until 21°C (70°F.) is reached. Maintain adequate relative humidity for birds brooded on the floor. The chicks seem to be comfortable and do best when relative humidity is between 40 and 60%.

Observing the chicks will tell you whether or not the temperature is correct. If they are too cool, they will huddle near the heat source. If they are too warm, they will spread out away from the heat source. If there are drafts, they will huddle in groups to get away from the spot where the cool air enters the heated area. Comfortable chicks will spread out uniformly, without huddling, throughout the brooding area.

Brooding Temperatures

Age	Cage Brooding		Floor Brooding	
	°C	°F	°C	°F
Day 1-3	35-37	95-99	35	95
Day 4-7	32-34	90-94	33	92
Day 8-14	29-31	85-89	31	89
Day 15-21	26-29	80-84	29	84
Day 22-28	24-26	75-79	26	79
Day 29-35	21-23	70-74	23	74
Day 36 →	21	70	21	70

Beak Trimming

The Hy-Line Brown pullet is most successfully beak trimmed at between seven and 10 days of age using a precision cam activated beak trimmer with guide plate holes of 4.0, 4.37 and 4.75 mm (10/64, 11/64 and 12/64 inches). The proper size hole should be selected to provide the width of 2 mm between the nostrils and the cauterizing ring. The proper size hole will depend both on size and age of chicks.

A cherry red blade has been recommended for proper cautery. However, a better way to measure blade temperature is by use of a pyrometer to keep the blade at approximately 595°C (1100°F.). The use of a line voltage meter and chart available from Lyon will facilitate maintaining the proper blade temperature at all times. A variation of 56°C (100°F.) is common due to external influences and cannot be detected by the human eye.

The following precautions must be observed at all times.

1. Do not beak trim sick birds.
2. Do not hurry.
3. Use electrolytes and vitamins (containing vitamin K) in the water two days before and two days after beak trimming.
4. Provide deeper feed for several days after beak trimming. If a coccidiostat is being used, supplement it with water soluble coccidiostats until feed consumption returns to normal.
5. Use only well trained crews for beak trimming.

Floor Systems Management

The Hy-Line variety Brown is widely used in floor systems due to her calm temperament and good livability. It is important to provide the birds with the best possible floor environment to achieve the performance potential of the Hy-Line variety Brown.

Growing Period

Birds should be grown in housing that allows adjustments to the lighting program and the light intensity. The lighting programs are usually similar to those used for birds in cage production, but light intensity may be different. It is important to provide floor grown birds with enough light intensity to allow them to navigate their environment. Week one light intensity of 20-30 lux (2-3 foot candles) should be used, dropping down to 15 lux (1.5 foot candles) by week four and remaining at this level until week 15. At week 15 gradually increase the light intensity, reaching 20-30 lux (2-3 foot candles) by the time the pullets are transferred to the layer house. Birds moving into open-sided housing should have higher light intensities of 30-40 lux (3-4 foot candles) at the time of housing.

It is essential that birds be on the same type of feeder and water system in the growing house that they will be on in the laying house. Birds will adapt better in the lay house if the growing house has perches. If birds are being grown at 9 birds/m^2 (1.2 sq. ft./bird) then each bird will need 6 cm (2.4 inches) of perch when using a A-frame construction. Use a spacing of 40 cm (16 inches) between perches and angle of 45^o. Ideally the growing house should have elevated bird walkways with the feed and water stations up on them.

Birds grown on the floor will often be as much as 50 g (0.1 Lbs.) lower in body weight at 12 weeks of age than cage grown birds. To offset any decrease in egg size, it is common to delay light stimulation until the pullets reach 1.5 Kg (3.31 Lbs.).

Birds are very sensitive to extremes of relative humidity (RH). It is common to see young flocks in floor houses with RH dropping below 30%. This will cause increased agitation of the chicks and can cause aggressive behavior. Ideally RH should be in the 40 or 60% range. Excessive moisture will cause poor litter conditions. Wet litter will be associated with high ammonia levels and poor air quality. This must be avoided to prevent respiratory problems.

The Hy-Line variety Brown pullet is usually beak trimmed either in the hatchery or at 7-10 days of age. In some floor systems it has been found to be beneficial to delay beak trimming until five weeks of age. Care must be taken not to reduce growth if beak trimming is done later.

Laying Period

Ensure that the feed and water systems in the growing and laying facilities are compatible. Check the lighting program and light intensity. Synchronize light times with the growing house. The birds will need bright light of at least 20 lux (2 foot candles). It is important not to have shadows in the lay house, as dark areas outside the nest will encourage floor eggs. Allow the pullets access to the nests during the day when they arrive. Place the pullets on the slats at housing. Walk the birds several times daily, particularly in the morning, to ensure the birds are finding feed and water.

Use of an electric fence is helpful in training the birds not to lay eggs in corners or near the walls. The fence must be turned on as soon as the birds are housed. Place the fence 5 cm (2 inches) away from the wall of the house and about 10 cm (4 inches) above the floor.

It is common practice to lift the nest box curtain as the birds train to the nests. This will help prevent smothering. If nests near the walls are being used more heavily then nests towards the center of the house, use false walls of 1 m (3 feet) wide coming out and down from the nest down about every 12 m (39 feet) along the line of nest boxes.

The litter area in layer houses should not be more than 60 cm (24 inches) below the slat area. Position lights so they do not cause shadows on the litter below the slat area. Ensure that the litter area has the highest light intensity with a lower light intensity at the front of the nest boxes.

An all slat floor house provides an excellent environment, however, birds housed in this type of housing should also be grown on an all slat or wire floor.

Disease Control

A flock of pullets or layers can only perform up to its genetic potential when disease influence is minimized. The appearance of various diseases can vary from a subclinical effect on performance to outright severe mortality. The diseases of economic importance vary widely between locations, but in every case the challenge is to identify and control those diseases.

Biosecurity and Eradication

Obviously the best way to deal with a disease is to avoid it. Care should always be exercised to prevent introducing new diseases onto a pullet or layer farm. Common disease carriers include people, vehicles, equipment, wild birds, animals, and chickens themselves. New flocks should be tested before being brought onto a farm and should have a known vaccination program.

Some diseases are best controlled by eradication. Examples include *Mycoplasma gallisepticum,* cholera, coryza and typhoid. The continuing cost of medicating or vaccinating for these diseases often justifies some extra one-time effort and expense for eradication. These bacterial diseases are more easily eradicated than most viral diseases.

Vertically Transmitted Diseases

Some diseases are known to be transmitted from infected breeders to their progeny. This requires the production and maintenance of disease-free breeders as a first step in the control of these diseases at the commercial level. All breeders directly under Hy-Line's control are free of *Mycoplasma gallisepticum, Mycoplasma synoviae,* S. *pullorum,* S. *gallinarum* (typhoid), *S. enteritidis*, and lymphoid leukosis. Due to the possibility of horizontal transmission of any of these diseases, later generations may not remain free. It is the responsibility of the breeding stock and commercial flock owner to prevent horizontal transmission of these diseases and continue testing to be assured of a negative status.

Vaccination

Certain diseases are too widespread or difficult to eradicate and require a routine vaccination program. In general, all layer flocks should be vaccinated against Newcastle, bronchitis, IBD and AE. The exact vaccination schedule depends upon many things such as disease exposures expected, maternal immunities, vaccine types available and routes of administration preferred. Therefore, no one program can be recommended for all locations. Following is a basic program typical for the United States where breeders receive an inactivated Newcastle-bronchitis-IBD vaccine.

Day one	Marek's Disease, HVT, SB-1, ±Rispen's
18–20 days	IBD intermediate strain in water
25 days	Newcastle B-1 and bronchitis, mild Mass. in water
28–30 days	IBD intermediate strain in water
7–8 weeks	Newcastle B-1 and bronchitis, regular Mass. in water or spray
10 weeks	Pox wingweb and AE wingweb, water or spray
14 weeks	Newcastle LaSota and bronchitis, mild Holland spray or Newcastle-bronchitis killed virus injection

Infectious Bursal Disease

Special attention should be paid to IBD control. This disease can have many subtle effects which are detrimental to pullet health. The primary feature of IBD is immunosuppression caused by damage to the bursa of Fabricius which leaves the bird unable to fend off other disease challenges. Secondary diseases such as gangrenous dermatitis, bacterial arthritis and even Marek's often result. Virtually all flocks are exposed to IBD and therefore, should be protected by vaccination. Most breeding stock receives a killed IBD vaccine to boost maternal titers in the chicks. Research at Hy-Line International has shown the optimum time to vaccinate such chicks with intermediate strain live vaccines is at 18–20 days and again at 28–30 days of age. Extremely severe IBD challenge may require even more frequent vaccination during this period. Bursas can be examined later to determine the extent of protection.

Floor and Intensive Systems
Internal Parasites

Worms

Worm infections cause damage to the bird's gut. This may result in a variety of problems including:

- Loss of shell color and strength, yolk color, and egg size.
- Poor body weight gain leading to unevenness or stunted birds. Affected birds may be dull and show pale combs.
- Increased cannibalism through vent pecking due to straining.
- Death, in very heavy infestations.

There are three main worms that may cause problems in free-range or cage birds:

1. **Roundworms (Ascaridia galli)**
   These are the biggest and most common. They are white, up to 5 cm (2 inches) long and may be visible in droppings in heavy infections.

2. **Hairworms (Capillaria)**
   These are much smaller (hair-like) and are barely visible with the naked eye but can cause significant damage even in only moderate infestations.

3. **Cecal Worms (Heterakis gallinarum)**
   As their name suggests, these worms, spend most of their time in the lower end of the gut, the ceca. Frequently they cause no obvious harm in themselves but can carry another parasite, Histomonas, into the birds. Histomonas is the cause of blackhead and hence control of one parasite can help to control another.

Birds become infected by picking up worm eggs from litter, soil, or feces. The worm eggs need warm moist conditions to develop outside the bird, which is why problems are frequently worse in the spring and summer, especially following a wet spring. Worm burdens can be identified by examination of feces, culled birds, or worm egg counts on bulk feces.

A product used for roundworm treatment in the United States is Piperazine at 50 mg/bird (0.1%) for 24 hours. A possible licensed dewormer in some countries for laying birds is Flubenvet, (Janssen Animal Health). This product has no withdrawal period, which means that it can be given in the feed during lay without the need to discard eggs, except in organic diets where eggs may need to be withheld.

Effective control is aimed at breaking the cycle of infection. Strategic use of deworming (in the rearing phase) will help to reduce challenge, but this needs to be combined with limiting stock density on land, the use of range rotation, good drainage, and the removal of heavily contaminated soil around the house before new pullets arrive.

Coccidiosis

This parasitic infection of the intestines can lead to gut damage and, in severe infestations, death of birds. More commonly, poor control of subclinical infection reduces feed conversion, or leaves pullets with chronic irreversible gut damage. Such flocks may be uneven or underweight at housing, and may not perform to their full potential in lay. Currently, effective control is achieved with drug treatments in feed that suppress oocyst output. These may involve the use of ionophores or chemicals on a step-down program to ensure a good build up of immunity in pullets. To avoid problems with drug resistance and continuous drug treatment, and help ensure even and target weight pullets, live vaccine is available that can be administered by spray in the hatchery or by feed or water application the first few days in the brooder house. All treatment/vaccination strategies should be supported with effective biosecurity. The use of a disinfectant with proven efficacy against coccidial oocysts will reduce challenge pressure. Maintenance of good dry litter will reduce oocyst build up.

External Parasites

Red Mite or Northern Fowl Mite

Mites are a cause of increasing problems in free-range and caged layers. It is particularly severe in the summer months when the weather is warm and mites are able to multiply quickly.

Even light infestations can irritate the birds, leading to poor performance and reduced feed intake. In more severe cases infestations can lead to some or all of the following.

- Mites irritate the birds and can make the flock unsettled and nervous.
- The incidence of peritonitis may increase and there may be increased vent pecking.
- Feed intake may be depressed.
- Heavy mite infestations can depress egg production by up to 5%.
- Heavy infestations of red mites will make birds anemic due to loss of blood. Birds will be evident in the flock with pale combs and, if severely affected, mortality may increase.
- There may be loss of shell or yolk color and, with heavy infestations of red mites, there will be evidence of mites and mite feces on eggs and egg belts, which may lead to downgrading of speckled eggs.
- There may be an increase in floor eggs as birds will be reluctant to use heavily infested nests.
- Where there are heavy mite infestations, egg collectors may experience skin irritation.

Control strategies involve two broad areas:

1. Breaking the cycle of reinfection when the house is empty is the most effective approach. Treat the houses effectively at site depletion with an approved product, properly applied, to reach into all crevices on equipment, slats, and nest boxes. Use a fan nozzle to produce a flat spray. Do not mix pesticides with disinfectants.

2. Monitor the house and birds during the life of the flock to allow prompt treatment even if only light infestations are identified. Programs for treatment to break the Northern Fowl Mite life cycle (5-7 days) should be done three times on day 0, 5, and 10. Treatment to break the Red Mite life cycle (10 days) should be done three times on day 0, 10, and 20.

Lighting Program

Egg production is very closely related to the changes in day length to which the pullets are exposed. Egg numbers, egg size, livability and total profitability can be favorably influenced by a proper lighting program. The basic rules of lighting are:

1. Start pullets with two days of 20-22 hours of light at 2 ftc. (20 lux) intensity. From two days to eight weeks, reduce light to 8-10 hours per day at ½ ftc. (5 lux) intensity. From eight weeks to 17 weeks, maintain a constant day length of 8-10 hours or that dictated by natural day length in open or brownout houses.
2. Provide light stimulation when body weight is 1.47 Kg (3.24 Lbs.). The initial increase should be no less than one hour. Increase light by 15–30 minutes per week or biweekly until 16 hours of light is reached. Preferably the period of stimulation should last until peak production. Light intensity should also be increased at housing to 1–2 ftc. (10–20 lux).
3. Allow no decrease in day length or light intensity in adult layers.

Local sunrise-sunset timetables should be obtained to accurately design individual programs. Guidelines for various housing styles are as follows:

1. **Light-controlled growing to light-controlled laying:**
   a. Grow on a constant 8-10 hour day length from eight to 17 weeks.
   b. Increase day length 1 hour at 1.47 Kg (3.24 Lbs.). Add 15-30 minutes per week until 16 hours total light is reached.
2. **Light-controlled growing to open or brownout laying:**
   a. Grow on a constant 8-10 hour day length from eight to 17 weeks.
   b. Increase to natural day length or a minimum increase of 1 hour at 1.43 Kg (3.24 Lbs.). Add 15-30 minutes per week or biweekly to reach 16 hours total light, or at least the longest natural day length of the year.
3. **Open or brownout growing to light-controlled laying:**
   a. Grow on a constant day length equal to the longest natural day length the flock will be exposed to from eight to 17 weeks.
   b. Increase day length one hour at 1.47 Kg (3.24 Lbs.). Add 15-30 minutes per week or biweekly until 16 hours of total light is reached.
4. **Open or brownout growing to open or brownout laying:**
   a. Grow on a constant day length equal to the longest natural day length the flock will be exposed to from eight to 17 weeks.
   b. Increase day length one hour at 1.47 Kg (3.24 Lbs.). Add 15-30 minutes per week or biweekly until 16 hours of total light is reached, or at least the longest natural day length of the year.

Timing of Light Stimulation

Onset of sexual maturity or egg production generally depends on four requirements:

1. A minimum chronological age which is genetically determined (17 weeks).
2. A minimum body weight.
3. A nutrient intake to support production.
4. A constant or increasing day length of at least 12 hours.

Light stimulation should not be provided until flocks reach the optimum body weight of 1470 grams (3.24 pounds). Flocks which are light-stimulated into production at lower body weights will likely produce below normal egg size and suffer from reduced peak production and post-peak drops in production.

Timing of light stimulation can be used as a tool to help attain desired egg size. In general, earlier light stimulation will result in a few more eggs per hen, but at a tradeoff for slightly reduced egg size. Later light stimulation will result in a few less total eggs, but a slightly larger egg size earlier in production.

In this way, lighting programs can be customized to best meet the egg size demand of a particular market.

Intermittent Lighting

Intermittent lighting can be used in light-controlled housing after 40 weeks of age to improve flock efficiency. The following effects have been shown:

1. Improved feed conversion of 5–7%.
2. Reduced feed intake of 5–7%.
3. Reduced egg size of 1–1.5%.
4. Reduced lighting power usage of 75%.
5. Slight improvement in shell strength.
6. Reduced heat stress morbidity and mortality.
7. Reduced cannibalism and activity problems.

A number of variations on intermittent lighting have been tried, but a commonly used one is to provide 15 minutes of light and 45 minutes of darkness for each hour of scheduled light in the day (15 Light 45 Darkness). The hens continue to recognize this as a full hour of light.

The program should be introduced gradually, starting with 45 L/15 D for every hour of light the first week, followed by 30 L/30 D for one week, and then 15 L/45 D thereafter. The final hour in the day should always end with 15 minutes of light (15 L/30 D/15 L) so that the total day length does not decrease while instituting the program.

Planning Individual Light Programs

When open-type houses are used, which allow natural day light to affect the flock, the lighting program must be planned in conjunction with changes in the natural day length. Because no two places have the same sunrise-sunset times year-round, it is impractical to suggest time clock settings that would apply to all locations. For the most precise planning, it is necessary to obtain local sunrise-sunset times for the entire year and construct a graph as the example on the following page demonstrates.

In this example, the growing flock is maturing in the spring when there is a naturally increasing day length. To prevent early sexual development, find the natural day length at 17 weeks of age and either hold that day length constant with artificial lights from eight to 17 weeks, or construct a stepdown program which will meet the natural day length at 17 weeks, allowing for some twilight before sunrise and after sunset.

Egg Size Management

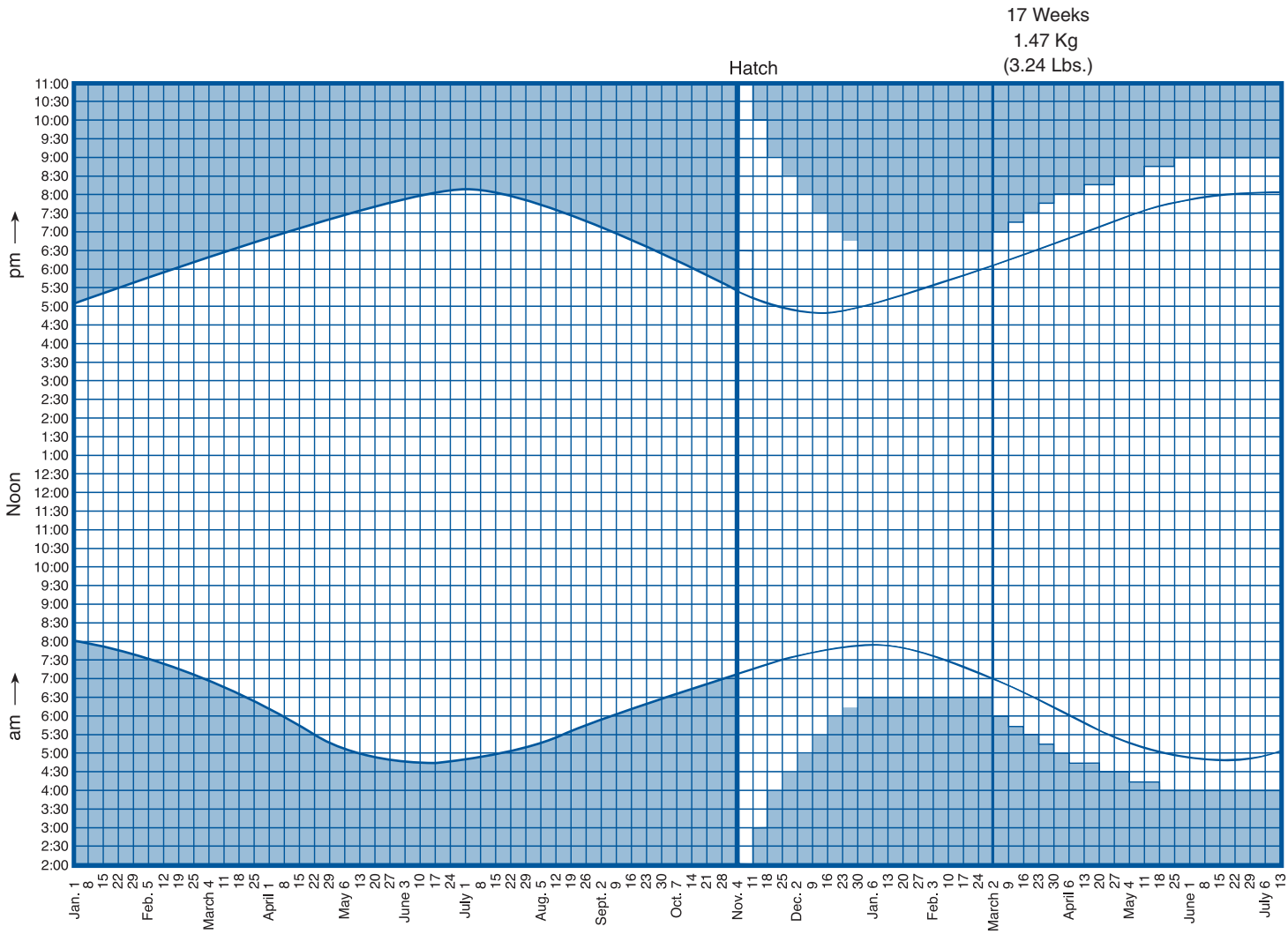
Egg size is to a large extent genetically determined, but within this given range, we can manage to either increase or decrease the egg size to suit the particular market needs.

The following management areas should be given particular attention.

1. **Body weight at maturity** — The larger the body weight at first egg, the larger that hen's eggs will be for her entire life. For optimum egg size, do not stimulate maturity with lights until a body weight of 1550–1600 grams (3.4–3.5 Lbs.) is attained.
2. **Rate of maturity** — This also relates to body size, but in general the earlier the age a flock begins production, the smaller the egg size will be, and likewise, the later the maturity, the larger the egg size. Lighting programs can be manipulated to influence rate of maturity. A decreasing light pattern continuing past 10 weeks will delay maturity and increase average egg size.
3. **Nutrition** — Egg size is greatly affected by the intake of crude protein, specific amino acids such as methionine and cystine, energy, total fat, and the essential fatty acids such as linoleic acid. Levels of these nutrients can be increased to improve early egg size and gradually reduced to control late egg size. (See layer feeding program page 14.)

Sunrise and Sunset

42° Latitude Northern Hemisphere



Growing Period Nutrition Recommendations

Product Age in Weeks			Starter 0-6	Grower 6-12	Developer 12-15	Pre-Layer 15-1% Production
Nutrient:						
Protein	%	Min.	20.00	17.50	15.50	16.50
Metabolisable	MJ/Kg		11.5-12.4	11.5-12.6	11.3-12.4	11.4-12.4
Energy	Kcal/Kg		2750-2970	2750-3025	2700-2970	2725-2980
	Kcal/Lb.		1250-1350	1250-1370	1225-1350	1235-1350
Lysine	%	Min.	1.10	0.90	0.66	0.80
Methionine	%	Min.	0.48	0.41	0.32	0.38
Methionine + Cystine	%	Min.	0.82	0.71	0.58	0.65
Tryptophan	%	Min.	0.20	0.19	0.18	0.19
Threonine	%	Min.	0.73	0.55	0.52	0.55
Calcium	%	Min.	1.00	1.00	1.00	2.75*
Av. Phosphorus	%	Min.	0.45	0.43	0.42	0.40
Sodium	%	Min.	0.18	0.18	0.18	0.18
Chloride	%	Min.	0.18	0.18	0.18	0.18

*At least 30-65% of the added limestone should have a minimum particle size of 2250 microns.

Growing Period Feed Consumption

Age in Weeks	Daily			Cumulative		
	Grams/Bird/Day	Lbs./100/Day	Kcal/Bird/Day	Grams to Date	Lbs. to Date	Kcal to Date
1	13	2.87	37	91	0.20	259
2	20	4.41	57	231	0.51	658
3	25	5.51	72	406	0.90	1162
4	29	6.39	83	609	1.34	1743
5	33	7.28	95	840	1.85	2408
6	37	8.16	106	1099	2.42	3150
7	41	9.04	114	1386	3.06	3948
8	46	10.14	128	1708	3.77	4844
9	51	11.24	141	2065	4.55	5831
10	56	12.35	155	2457	5.42	6916
11	61	13.45	169	2884	6.36	8099
12	66	14.55	183	3346	7.38	9380
13	70	15.43	189	3836	8.46	10703
14	73	16.09	197	4347	9.58	12082
15	75	16.53	203	4872	10.74	13503
16	77	16.98	212	5411	11.93	14987
17	80	17.64	220	5971	13.16	16527

Monitoring Body Weights

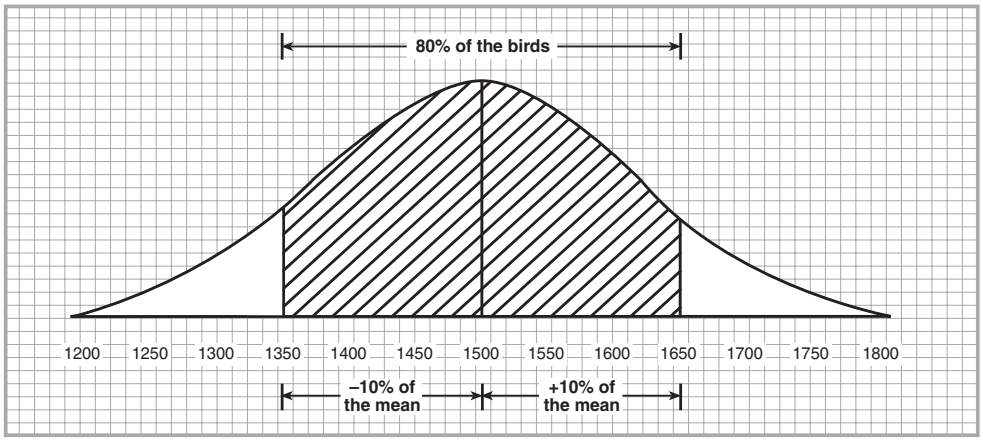
Body weights should be monitored periodically during the growing period and until after peak. At least 100 birds should be weighed individually with a scale having increments no larger than 50 grams or 1/10 Lb. Weighing should be started at five weeks of age and continued every two weeks during the growing period and until after peak. It is most critical to weigh just prior to a scheduled feed change. If the flock is below target body weight, it should be left on the higher nutrient feed formulation until the target weight for age is reached.

In addition to body weight averages, the uniformity of body weights within the flock is an indicator of normal flock development. Uniformity is expressed as the percent of individual weights which occur within 10% of the current flock average. A realistic goal is for 80% uniformity.

Factors which can adversely affect body weight and uniformity are crowding, disease, poor beak trimming and inadequate nutrient intake. Weighing at frequent intervals will determine the age at which a flock deviates from normal and thereby help identify the problem so that corrective measures can be taken.

Variability Between Individual Birds Within A Flock

Uniformity of individual birds is important as well as appropriate average flock weights. A desirable goal is for 80% of birds to fall within 10% of the mean. That is, if the average flock weight at 18 weeks is 1500 grams, 80% of all birds should weigh between 1350 and 1650 grams. Graph individual weights to be sure there is a bell shaped or "normal" distribution as shown below. To evaluate uniformity, at least 100 birds should be weighed.



Target Weights of Hy-Line Brown Pullets – Rearing Period –

Age in Weeks	Body Weight* Grams	Pounds	
1	70	0.15	
2	115	0.25	
3	190	0.42	
4	280	0.62	
5	380-390	0.84-0.86	
6	480-500	1.06-1.10	
7	580-620	1.28-1.37	
8	680-750	1.50-1.65	
9	770-860	1.70-1.90	
10	870-970	1.92-2.14	
11	960-1080	2.12-2.38	
12	1050-1170	2.31-2.58	
13	1130-1250	2.49-2.76	
14	1210-1310	2.67-2.89	
15	1290-1370	2.84-3.02	
16	1360-1430	3.00-3.15	
17	1430-1490	3.15-3.28	Move to Lay House
18	1500-1540	3.31-3.40	

* Pullets grown in cages in moderate climates will be near the top of the range shown. Birds grown on the floor, or in a tropical climate, will be near the lower end of the range.

Laying Period Nutrition

Minimum Daily Intake Recommendations per Bird

	Peaking[1] 1% Prod. – 32 Weeks	32–44 Wks.[1]	44–55 Wks.[1]	55 Wks. +[1]
Protein, g/bird	18.00	17.50	17.00	16.00
Methionine, mg/bird	460	460	410	380
Methionine + Cystine, mg/bird	760	760	680	630
Lysine, mg/bird	930	930	890	830
Tryptophan, mg/bird	200	200	190	170
Threonine, mg/bird	650	650	620	600
Calcium, g/bird	4.00	4.25	4.50	4.75
Phosphorus, (Available) g/bird	0.44	0.40	0.36	0.35
Sodium, mg/bird	180	180	180	180
Chloride, mg/bird	180	180	180	180

Formula Nutrient Profiles to Provide Recommendations for Lay Cycle Nutrient Intake

1% to 32 Weeks Peaking[1]

Recommended Feed Energy 1260–1300 Kcal./Lb. or 2770–2860 Kcal/Kg or 11.60-11.97 MJ/Kg[3]

Consumption Bird/Day Grams	Lbs.	% Protein	% Methionine	% Methionine + Cystine	% Lysine	% Tryptophan	% Threonine	% Calcium[2]	% Avail. Phos.	% Sodium
91	0.20	19.80	0.51	0.84	1.02	0.22	0.72	4.40	0.48	0.20
95	0.21	18.85	0.48	0.79	0.97	0.21	0.68	4.20	0.46	0.19
100	0.22	18.00	0.46	0.76	0.93	0.20	0.65	4.00	0.44	0.18
104	0.23	17.20	0.44	0.73	0.88	0.19	0.62	3.85	0.42	0.17
109	0.24	16.50	0.42	0.69	0.85	0.18	0.60	3.65	0.40	0.16

32–44 Weeks[1]

Recommended Feed Energy 1240–1300 Kcal./Lb. or 2725–2860 Kcal/Kg or 11.41-11.97 MJ/Kg[3]

Consumption Bird/Day Grams	Lbs.	% Protein	% Methionine	% Methionine + Cystine	% Lysine	% Tryptophan	% Threonine	% Calcium[2]	% Avail. Phos.	% Sodium
100	0.22	17.50	0.46	0.76	0.93	0.20	0.65	4.25	0.40	0.18
104	0.23	16.75	0.44	0.73	0.89	0.19	0.62	4.10	0.38	0.17
109	0.24	16.05	0.42	0.69	0.85	0.18	0.60	3.90	0.37	0.17
113	0.25	15.40	0.40	0.66	0.82	0.18	0.57	3.75	0.35	0.16

44–55 Weeks[1]

Recommended Feed Energy 1215–1300 Kcal./Lb. or 2675–2860 Kcal/Kg or 11.20-11.97 MJ/Kg[3]

Consumption Bird/Day Grams	Lbs.	% Protein	% Methionine	% Methionine + Cystine	% Lysine	% Tryptophan	% Threonine	% Calcium[2]	% Avail. Phos.	% Sodium
100	0.22	17.00	0.41	0.68	0.89	0.19	0.62	4.50	0.36	0.18
104	0.23	16.25	0.39	0.65	0.85	0.18	0.59	4.35	0.34	0.17
109	0.24	15.60	0.38	0.62	0.82	0.17	0.57	4.15	0.33	0.17
113	0.25	14.95	0.36	0.60	0.78	0.17	0.55	4.00	0.32	0.16

55 Weeks and Older[1]

Recommended Feed Energy 1160–1285 Kcal./Lb. or 2550–2825 Kcal/Kg or 10.68-11.83 MJ/Kg[3]

Consumption Bird/Day Grams	Lbs.	% Protein	% Methionine	% Methionine + Cystine	% Lysine	% Tryptophan	% Threonine	% Calcium[2]	% Avail. Phos.	% Sodium
100	0.22	16.00	0.38	0.63	0.83	0.17	0.60	4.75	0.35	0.18
104	0.23	15.30	0.36	0.60	0.79	0.16	0.57	4.55	0.33	0.17
109	0.24	14.65	0.35	0.58	0.76	0.15	0.55	4.35	0.32	0.17
113	0.25	14.10	0.33	0.55	0.73	0.14	0.53	4.20	0.31	0.16

(1) Rations should provide suggested nutrient intake on a per bird per day basis independent of feed intake.
(2) Approximately 65% of the added limestone should be in particle sizes of 2250 microns.
(3) The lower dietary feed energy recommendations generally are for the higher feed intakes.

Added Vitamins and Minerals

Added Vitamins per Ton Finished Feed: (minimum)		Grower	Layer
Vitamin A	IU	10,000,000	8,000,000
Vitamin D	IU	3,000,000	3,000,000
Vitamin E	IU	25,000	15,000
Vitamin K	mg	3,000	2,000
Vitamin B1	g	2	1
Vitamin B2	g	8	5
Vitamin B6	g	3	2.5
Vitamin B12	mg	20	25
Biotin	mg	100	*
Folic Acid	mg	1,000	500
Choline	g	300	200
Niacin	g	30	25
Pantothenic Acid	g	10	6
Added Trace Elements Per Ton Finished Feed: (minimum)		**Grower**	**Layer**
Copper	g	20	10
Iron	g	50	50
Iodine	g	1.5	1
Manganese	g	100	100
Selenium	g	0.27	0.27
Zinc	g	70	80

* No Biotin in layer diets if corn based, otherwise supplement same as growing diets.

Laying Period Feed Consumption and Energy Intake

The amount of feed a flock consumes is dependent on several factors. Consumption will vary according to feed nutrient content (particularly caloric content), house temperature, rate of production, egg size and body weight.

The following table suggests expected feed consumption for the Hy-Line Brown layer under normal field conditions using an energy adequate diet. Minimum daily energy values can be calculated from the energy prediction equation on page 16, assuming standard body weight, production and egg size values from the performance table (pages 18 and 19) and an environmental temperature of approximately 26.7°C (80°F.). For every one-half degree Celsius (one degree Fahrenheit) higher or lower average temperature, subtract or add about two Kcal. per bird per day respectively.

Age in Weeks	Grams/Bird/Day	Lbs./100/Day	Kcal./Bird/Day	Age in Weeks	Grams/Bird/Day	Lbs./100/Day	Kcal./Bird/Day
18	83	18.2	227	50	111	24.6	306
19	86	19.0	237	51	112	24.6	306
20	89	19.7	246	52	112	24.6	305
21	92	20.3	253	53	112	24.6	305
22	95	20.9	267	54	112	24.6	304
23	98	21.5	275	55	112	24.6	304
24	100	22.1	282	56	112	24.6	304
25	103	22.6	289	57	112	24.6	304
26	105	23.1	295	58	112	24.7	303
27	106	23.4	299	59	112	24.7	303
28	108	23.7	303	60	112	24.7	303
29	108	23.8	304	61	112	24.7	303
30	108	23.9	305	62	112	24.7	303
31	109	24.0	306	63	112	24.7	303
32	109	24.1	306	64	112	24.7	303
33	110	24.2	307	65	112	24.7	303
34	110	24.2	307	66	112	24.7	303
35	110	24.3	308	67	112	24.7	303
36	110	24.3	308	68	112	24.8	303
37	111	24.4	309	69	112	24.8	303
38	111	24.4	309	70	112	24.8	303
39	111	24.5	310	71	112	24.8	303
40	111	24.5	310	72	112	24.8	303
41	111	24.5	310	73	112	24.8	303
42	111	24.5	310	74	113	24.8	303
43	111	24.5	309	75	113	24.8	303
44	111	24.5	308	76	113	24.8	303
45	111	24.5	308	77	113	24.8	303
46	111	24.5	307	78	113	24.8	303
47	111	24.5	307	79	113	24.9	303
48	111	24.6	307	80	113	24.9	303
49	111	24.6	306				

Energy Management

Energy requirements of growing and laying flocks need to be determined and managed as with the other common nutrients. Although birds do tend to adjust consumption to meet energy need, this is not always done precisely enough to insure optimum growth or performance. Added energy in the feed will at times result in better body weight gain, or egg production.

The energy need of a brown egg layer under a moderate temperature range can be marginally estimated with the following equation:

$$\text{Kcal./bird/day} = W(140 - 2T) + 2E + 5\triangle W$$

where W = current body weight in kilograms

T = average ambient temperature in degrees celsius.

E = daily egg mass in g/bird/day

$$\frac{(\%\ \text{production} \times \text{egg weight in grams})}{100}$$

$\triangle$ W = body weight gain in g/bird/day

The current energy consumption of a flock can be determined as follows:

Kcal./Lb. feed × Lb./100/day ÷ 100 = Kcal./bird/day

Kcal/Kg feed × g/bird/day ÷ 1000 = Kcal/bird/day

Likewise the calorie content needed in the feed to achieve a certain daily intake can be calculated as follows:

$$\text{Kcal./Lb. feed} = \frac{\text{Kcal./bird/day (desired)} \times 100}{\text{current Lbs./100/day}}$$

$$\text{Kcal/Kg feed} = \frac{\text{Kcal/bird/day (desired)} \times 1000}{\text{current g/bird/day}}$$

Increased nutrient density of feed is useful at certain times, especially when energy consumption may be a restricting factor. This includes the critical period between housing and peak production. Flocks consuming less than 285 Kcal./bird/day at peak production tend to suffer post-peak dips in production and reduced egg size. Heat stress will also result in lower feed and energy consumption. Increased nutrient density, to include energy (added fat) will help maintain production and egg size when environmental temperatures are high.

Fat is a concentrated source of energy which can be useful in increasing feed energy. It also has the benefit of a relatively low heat increment which is useful during periods of heat stress. Vegetable oils are typically high in linoleic acid which benefits egg size, although a blend of vegetable oil and animal fat may be acceptable.

The table below is a guideline for using fat at different ages and environmental temperatures. As fat is added to the ration, care should be exercised to increase the other nutrients in proportion to energy.

	Added Fat (%)		
Housing Daily Highs	**Growing**	**To Peak**	**Post Peak**
Above 35°C (95°F.)	3%	3%	2%
30°C (86°F.) to 35°C (95°F.)	2%	2%	1%
Below 30°C (86°F.)	0	1%	0

Water Consumption

Water consumption is directly related to temperature and feed consumption. Feed consumption (calorie intake) is inversely related to temperature. A rule of thumb is that in the normal temperature range of bird comfort, 20-25°C (68-77° F.), birds drink twice as much water as the feed consumed. The ratio changes at higher temperatures because less feed but more water is consumed.

Water Consumption for Brown Pullets and Layers

Water Consumed per 100 Birds*

Age in Weeks	Liters	Gallons	Age in Weeks	Liters	Gallons
1	2.9	0.8	12	15.7	4.1
2	5.7	1.5	14	15.7	4.1
4	10.0	2.6	16	17.1	4.5
6	11.4	3.0	18	18.6	4.9
8	12.9	3.4	20	21.4	5.7
10	14.3	3.8	>25	21.0 - 26.5	5.5 - 7.0

*1 - 20 week estimates from Nutrient Requirement of Poultry, 9th ed., 1994; layer estimate from field data

Ventilation

Ventilation should be used as a major management tool to provide the optimum micro-environment per bird. Controlled ventilation can do a great deal to dilute pathogenic organisms as well as provide an optimum micro-environment when ventilation equipment is designed and operated to give correct air speed and direction.

A general rule for figuring required fan capacity is four cubic meters of air movement per kilogram of body weight per hour (one cubic foot per minute per pound of body weight).

The birds' optimum environmental temperatures and humidity should be in the range of 21-27°C (70-80°F.) and 40-60% relative humidity.

SUGGESTED MINIMUM VENTILATION RATES

CUBIC FEET PER MINUTE PER BIRD AGE OF BIRDS							CUBIC METERS PER HOUR PER BIRD AGE OF BIRDS						
Outside Temperature	**First Week**	**3 Weeks**	**6 Weeks**	**12 Weeks**	**18 Weeks**	**Beyond 18 Weeks**	**Outside Temperature**	**First Week**	**3 Weeks**	**6 Weeks**	**12 Weeks**	**18 Weeks**	**Beyond 18 Weeks**
90°F	1.0	1.5	2.0	3.0	4.0	6-7	35°C	2.0	3.0	4.0	6.0	8.0	12-14
70°F	0.7	1.0	1.5	2.0	3.0	4-5	20°C	1.4	2.0	3.0	4.0	6.0	8-10
50°F	0.4	0.7	1.0	1.5	2.0	2.5-3	10°C	0.8	1.4	2.0	3.0	4.0	5-6
30°F	0.3	0.5	0.7	1.0	1.5	2-2.5	0°C	0.6	1.0	1.5	2.0	3.0	4.5
10°F	0.2	0.3	0.5	0.7	1.0	1.5-2	–10°C	0.5	0.8	1.2	1.7	2.5	3-4
–10°F	0.1	0.2	0.3	0.5	0.5	1-1.5	–20°C	0.3	0.6	0.9	1.2	1.5	2.3

Recommended Cage Densities for the Hy-Line Brown Layer

	EU Guidelines	U.S. Recommended (UEP)
Cage space	450 sq cm (70 sq. in.)	432-555 sq cm (64 sq. in.)
Feeder space	10 cm/bird (4"/bird)	7.6 cm/bird (3"/bird)
Water space	access to 2 cups or nipples/cage	2 cups or nipples/12 birds or 1 trough/bird

Hy-Line Variety Brown Performance Table

Age in Weeks	% Hen-Day	% Mortality Cum.	Hen-Day Eggs Cum.	Hen-Housed Eggs Cum.	Body Weight Kg	Body Weight Lbs.	Average Egg Weight* g/Egg	Average Egg Weight* Oz./Doz.	Average Egg Weight* Net Lbs./ 30 Doz. Case	Egg Mass Cum. Kg	Egg Mass Cum. Lbs.	Egg Quality Haugh Units	Egg Quality Shell Thickness (mm)	Egg Quality Specific Gravity
18		.1			1.50	3.31								
19	9	.1	0.6	0.6	1.57	3.46	46.6	19.7	37.0	0.0	0.1	103.2	0.352	1.088
20	28	.1	2.6	2.6	1.64	3.61	47.7	20.2	37.9	0.1	0.3	102.7	0.352	1.088
21	54	.2	6.4	6.4	1.71	3.76	50.0	21.2	39.7	0.3	0.7	102.2	0.352	1.088
22	78	.2	11.8	11.8	1.76	3.88	52.5	22.2	41.7	0.6	1.3	101.7	0.352	1.088
23	90	.3	18.1	18.1	1.80	3.98	54.8	23.2	43.5	0.9	2.1	101.3	0.352	1.088
24	93	.3	24.6	24.6	1.84	4.06	57.0	24.1	45.2	1.3	2.9	100.8	0.352	1.088
25	94	.4	31.2	31.1	1.85	4.09	59.0	25.0	46.8	1.7	3.8	100.4	0.352	1.088
26	95	.4	37.9	37.8	1.87	4.12	60.0	25.4	47.6	2.1	4.6	99.9	0.351	1.088
27	95	.5	44.5	44.4	1.88	4.14	60.6	25.7	48.1	2.5	5.5	99.5	0.351	1.087
28	95	.5	51.2	51.0	1.89	4.17	61.3	26.0	48.7	2.9	6.4	99.0	0.351	1.087
29	95	.6	57.8	57.6	1.90	4.19	61.6	26.1	48.9	3.3	7.3	98.6	0.351	1.087
30	94	.6	64.4	64.1	1.91	4.21	62.0	26.3	49.2	3.7	8.2	98.1	0.351	1.087
31	94	.7	71.0	70.7	1.91	4.22	62.4	26.4	49.5	4.1	9.1	97.7	0.351	1.087
32	94	.7	77.6	77.2	1.91	4.22	62.7	26.6	49.8	4.6	10.0	97.2	0.351	1.087
33	94	.8	84.1	83.7	1.92	4.22	63.0	26.7	50.0	5.0	11.0	96.7	0.351	1.087
34	94	.8	90.7	90.3	1.92	4.22	63.3	26.8	50.2	5.4	11.9	96.3	0.351	1.086
35	94	.9	97.3	96.8	1.92	4.23	63.5	26.9	50.4	5.8	12.8	95.8	0.351	1.086
36	94	.9	103.9	103.3	1.92	4.23	63.7	27.0	50.6	6.2	13.7	95.4	0.351	1.086
37	93	1.0	110.4	109.7	1.92	4.23	63.9	27.1	50.7	6.6	14.6	94.9	0.351	1.086
38	93	1.0	116.9	116.2	1.92	4.23	64.1	27.2	50.9	7.1	15.6	94.5	0.351	1.086
39	92	1.1	123.3	122.6	1.92	4.23	64.2	27.2	51.0	7.5	16.5	94.0	0.351	1.086
40	92	1.1	129.8	128.9	1.92	4.23	64.3	27.2	51.0	7.9	17.4	93.6	0.351	1.086
41	92	1.2	136.2	135.3	1.92	4.23	64.4	27.3	51.1	8.3	18.3	93.1	0.351	1.086
42	92	1.2	142.7	141.7	1.92	4.24	64.5	27.3	51.2	8.7	19.2	92.7	0.350	1.085
43	91	1.3	149.0	147.9	1.92	4.24	64.6	27.4	51.3	9.1	20.1	92.2	0.350	1.085
44	91	1.3	155.4	154.2	1.92	4.24	64.7	27.4	51.3	9.5	21.0	91.7	0.350	1.085
45	91	1.4	161.8	160.5	1.92	4.24	64.8	27.4	51.4	9.9	21.9	91.3	0.350	1.085
46	90	1.5	168.1	166.7	1.92	4.24	64.9	27.5	51.5	10.4	22.8	90.8	0.350	1.085
47	90	1.5	174.4	172.9	1.92	4.24	65.0	27.5	51.6	10.8	23.7	90.4	0.350	1.085
48	89	1.6	180.6	179.1	1.92	4.24	65.1	27.6	51.7	11.2	24.6	89.9	0.350	1.085
49	89	1.6	186.8	185.2	1.93	4.25	65.2	27.6	51.7	11.6	25.5	89.5	0.350	1.085
50	88	1.7	193.0	191.2	1.93	4.25	65.3	27.7	51.8	12.0	26.4	89.0	0.350	1.084

*Egg weights after 40 weeks of age assume phase feeding of protein to limit egg size.

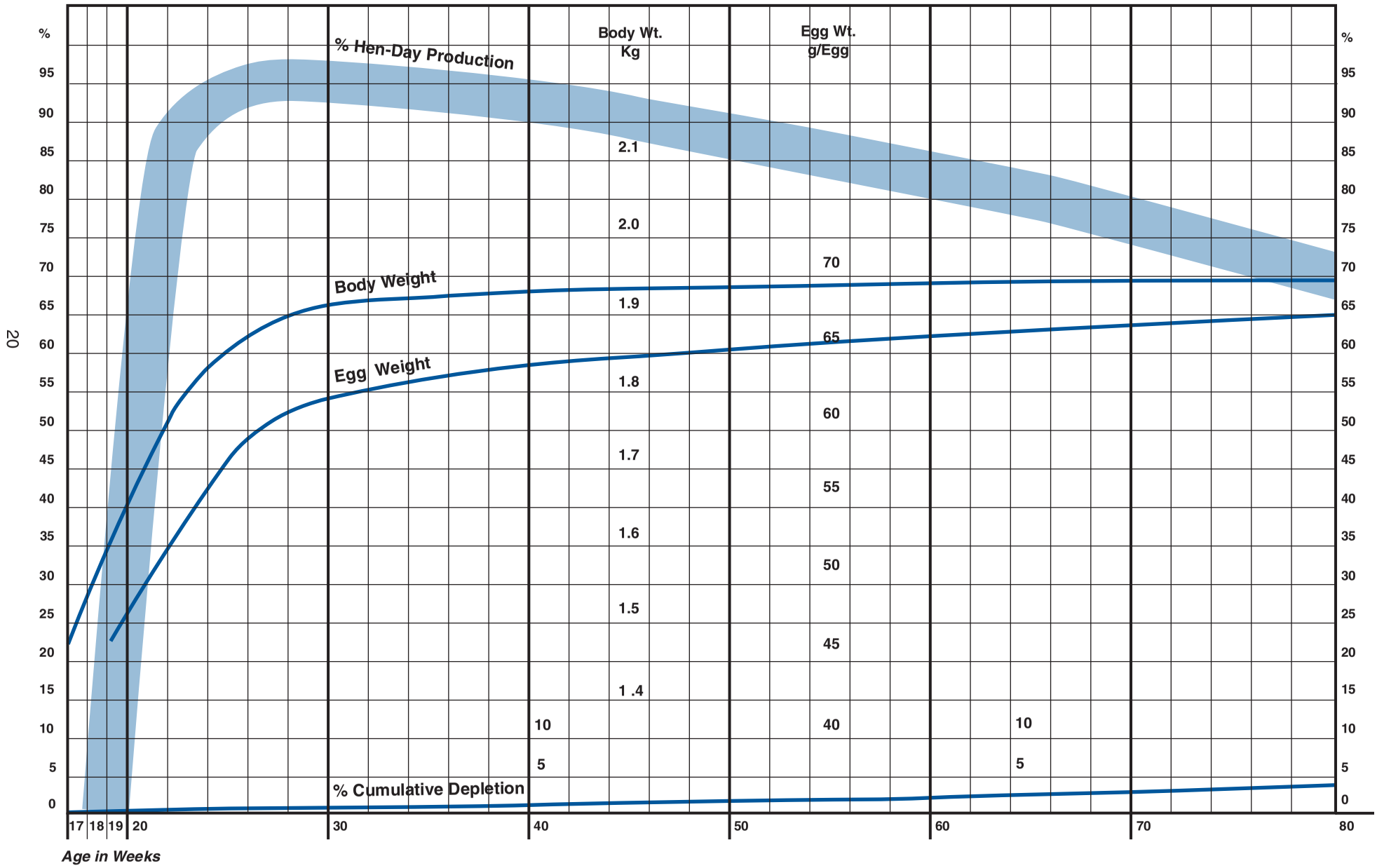
Hy-Line Variety Brown Performance Table

Age in Weeks	% Hen-Day	% Mortality Cum.	Hen-Day Eggs Cum.	Hen-Housed Eggs Cum.	Body Weight		Average Egg Weight*			Egg Mass Cum.		Egg Quality		
					Kg	Lbs.	g/Egg	Oz./Doz.	Net Lbs./ 30 Doz. Case	Kg	Lbs.	Haugh Units	Shell Thickness (mm)	Specific Gravity
51	88	1.8	199.2	197.3	1.93	4.25	65.4	27.7	51.9	12.4	27.3	88.6	0.350	1.084
52	88	1.8	205.3	203.3	1.93	4.25	65.5	27.7	52.0	12.8	28.2	88.1	0.350	1.084
53	87	1.9	211.4	209.3	1.93	4.25	65.6	27.8	52.1	13.2	29.1	87.7	0.350	1.084
54	87	2.0	217.5	215.3	1.93	4.25	65.7	27.8	52.1	13.6	30.0	87.2	0.350	1.084
55	86	2.0	223.5	221.2	1.93	4.25	65.8	27.9	52.2	14.0	30.8	86.7	0.350	1.084
56	86	2.1	229.5	227.1	1.93	4.25	65.9	27.9	52.3	14.4	31.7	86.3	0.350	1.084
57	85	2.2	235.5	232.9	1.93	4.26	66.0	28.0	52.4	14.8	32.6	85.8	0.349	1.083
58	85	2.2	241.4	238.7	1.93	4.26	66.1	28.0	52.5	15.2	33.4	85.4	0.349	1.083
59	84	2.3	247.3	244.5	1.93	4.26	66.2	28.0	52.5	15.6	34.3	84.9	0.349	1.083
60	84	2.4	253.2	250.2	1.93	4.26	66.3	28.1	52.6	15.9	35.2	84.5	0.349	1.083
61	83	2.5	259.0	255.9	1.93	4.26	66.4	28.1	52.7	16.3	36.0	84.0	0.349	1.083
62	83	2.5	264.8	261.5	1.93	4.26	66.5	28.2	52.8	16.7	36.9	83.6	0.349	1.083
63	82	2.6	270.6	267.1	1.93	4.26	66.5	28.2	52.8	17.1	37.7	83.1	0.349	1.083
64	82	2.7	276.3	272.7	1.93	4.27	66.6	28.2	52.9	17.5	38.5	82.7	0.349	1.083
65	81	2.7	282.0	278.2	1.94	4.27	66.7	28.3	52.9	17.9	39.4	82.2	0.349	1.082
66	81	2.8	287.6	283.7	1.94	4.27	66.8	28.3	53.0	18.2	40.2	81.7	0.349	1.082
67	80	2.9	293.2	289.2	1.94	4.27	66.8	28.3	53.0	18.6	41.0	81.3	0.349	1.082
68	80	3.0	298.8	294.6	1.94	4.27	66.9	28.3	53.1	19.0	41.9	80.8	0.349	1.082
69	79	3.1	304.4	300.0	1.94	4.27	66.9	28.3	53.1	19.4	42.7	80.4	0.349	1.082
70	78	3.2	309.8	305.2	1.94	4.27	66.9	28.3	53.1	19.7	43.5	79.9	0.349	1.082
71	77	3.3	315.2	310.5	1.94	4.28	67.0	28.4	53.2	20.1	44.3	79.5	0.349	1.082
72	76	3.4	320.5	315.6	1.94	4.28	67.0	28.4	53.2	20.4	45.1	79.0	0.349	1.081
73	76	3.5	325.9	320.7	1.94	4.28	67.0	28.4	53.2	20.8	45.9	78.6	0.348	1.081
74	75	3.6	331.1	325.8	1.94	4.28	67.0	28.4	53.2	21.1	46.6	78.1	0.348	1.081
75	74	3.7	336.3	330.8	1.94	4.28	67.1	28.4	53.3	21.5	47.4	77.7	0.348	1.081
76	74	3.8	341.5	335.8	1.94	4.28	67.1	28.4	53.3	21.8	48.2	77.2	0.348	1.081
77	73	3.9	346.6	340.7	1.94	4.28	67.1	28.4	53.3	22.2	48.9	76.7	0.348	1.081
78	72	4.0	351.6	345.5	1.94	4.28	67.1	28.4	53.3	22.5	49.7	76.3	0.348	1.081
79	71	4.1	356.6	350.3	1.94	4.29	67.2	28.5	53.3	22.9	50.4	75.8	0.348	1.081
80	70	4.2	361.5	355.0	1.94	4.29	67.2	28.5	53.3	23.2	51.1	75.4	0.348	1.080

*Egg weights after 40 weeks of age assume phase feeding of protein to limit egg size.

Hy-Line BRAND LAYERS

Hy-Line Brown Hen-Day Performance Graph



Egg Size Distribution – U.S. Standards

Age in Weeks	Average Egg Weight (Lbs./Case)	Jumbo Over 30 Oz./Doz.	Extra Large 27–30 Oz./Doz.	Large 24–27 Oz./Doz.	Medium 21–24 Oz./Doz.	Small 18–21 Oz./Doz.	Peewee Under 18 Oz./Doz.
20	37.9	0.0	0.0	2.5	31.5	53.0	13.1
22	41.7	0.0	0.9	18.2	53.6	25.4	1.9
24	45.2	0.3	8.8	43.2	40.3	7.1	0.2
26	47.6	2.0	21.7	49.6	24.2	2.4	0.1
28	48.7	3.5	28.4	48.8	17.9	1.4	0.0
30	49.2	4.4	32.2	48.1	14.6	0.9	0.0
32	49.8	5.1	36.3	47.1	11.1	0.4	0.0
34	50.2	6.1	39.9	45.1	8.6	0.3	0.0
36	50.6	7.1	42.1	43.1	7.5	0.2	0.0
38	50.9	7.5	45.2	41.6	5.7	0.1	0.0
40	51.0	8.5	45.7	40.1	5.6	0.1	0.0
42	51.2	9.2	46.6	38.9	5.2	0.1	0.0
44	51.3	10.4	47.0	37.5	5.0	0.1	0.0
46	51.5	11.1	47.6	36.5	4.7	0.1	0.0
48	51.7	12.4	48.0	35.0	4.6	0.1	0.0
50	51.8	13.2	48.7	33.9	4.2	0.1	0.0
52	52.0	14.6	48.8	32.4	4.1	0.1	0.0
54	52.1	15.5	49.1	31.5	3.8	0.1	0.0
56	52.3	16.5	49.4	30.3	3.8	0.1	0.0
58	52.5	17.8	49.4	29.3	3.5	0.1	0.0
60	52.6	19.3	49.3	28.0	3.3	0.1	0.0
62	52.8	20.4	49.1	27.2	3.2	0.1	0.0
64	52.9	21.1	48.9	26.8	3.1	0.1	0.0
66	53.0	22.5	48.6	25.8	3.0	0.1	0.0
68	53.1	23.2	48.3	25.5	3.0	0.1	0.0
70	53.1	23.5	48.1	25.4	3.0	0.1	0.0
72	53.2	24.0	48.0	24.9	3.0	0.1	0.0
74	53.2	24.0	48.0	24.9	3.0	0.1	0.0
76	53.3	25.1	47.3	24.6	3.0	0.1	0.0
78	53.3	25.1	47.3	24.6	3.0	0.1	0.0
80	53.3	26.1	46.6	24.2	3.0	0.1	0.0

Egg Size Distribution – European Standards

Age in Weeks	Average Egg Weight (g)	Very Large Over 73g	Large 63–73g	Medium 53–63g	Small 43–53g
20	47.7	0.0	0.0	12.4	87.5
22	52.5	0.0	1.4	44.4	54.2
24	57.0	0.1	11.9	66.4	21.6
26	60.0	0.7	27.9	62.1	9.3
28	61.3	1.4	36.1	56.7	5.9
30	62.0	1.7	40.7	53.5	4.2
32	62.7	2.0	45.6	49.8	2.6
34	63.3	2.4	50.1	45.8	1.8
36	63.7	2.9	52.8	42.9	1.5
38	64.1	2.9	56.3	39.7	1.1
40	64.3	3.5	57.2	38.4	0.9
42	64.5	3.8	58.4	36.9	0.9
44	64.7	4.5	59.1	35.6	0.9
46	64.9	4.9	60.1	34.2	0.8
48	65.1	5.7	60.6	33.0	0.7
50	65.3	6.2	61.6	31.6	0.7
52	65.5	7.1	62.2	30.1	0.7
54	65.7	7.6	62.5	29.2	0.7
56	65.9	8.6	62.7	28.0	0.6
58	66.1	9.2	63.2	27.0	0.6
60	66.3	10.3	63.5	25.6	0.6
62	66.5	11.0	63.6	24.9	0.5
64	66.6	11.4	63.8	24.3	0.5
66	66.8	12.5	63.5	23.6	0.5
68	66.9	13.0	63.1	23.5	0.5
70	66.9	13.4	62.9	23.2	0.5
72	67.0	13.8	62.9	22.8	0.5
74	67.0	13.8	62.9	22.8	0.5
76	67.1	14.7	62.2	22.6	0.5
78	67.1	14.7	62.2	22.6	0.5
80	67.2	15.6	61.5	22.4	0.5

Feed Ingredient Analysis Table[1]

Ingredient	Dry Matter %	Crude Protein %	Fat % (Ether Extract)	Fiber %	M.E. Kcal/Lb. Poultry	Calcium %	Phosphorus %	Avail. Phosphorus %	Potassium %	Sodium %	Chlorine %	Ash %	Choline mg/Lb.	Arginine %	Lysine %	Methionine %	Cystine %	Tryptophan %	Threonine %	Bulk Density (Lb./Cu. Ft.)	Linoleic Acid %	Xanthophyll (mg/Lb.)
Alfalfa Meal, dehydrated	93.0	17.5	3.0	25.0	750	1.30	0.27	0.27	2.49	0.09	0.46	9.0	680	0.75	0.73	0.28	0.18	0.45	0.75	20	—	100.0
Bakery Product, dried	91.5	10.0	11.5	0.7	1700	0.06	0.40	0.10	0.80	1.14	1.48	5.4	560	0.40	0.30	0.50	0.16	0.09	0.60	40	1.5	—
Barley	89.0	11.6	1.8	5.0	1250	0.07	0.36	0.11	0.49	0.05	0.03	3.0	450	0.50	0.50	0.16	0.25	0.13	0.36	25	—	—
Barley, West Coast	88.0	9.7	2.0	6.5	1255	0.05	0.33	0.10	0.44	0.02	0.10	2.4	425	0.43	0.36	0.16	0.20	0.13	0.30	22	—	—
Beet Pulp	92.0	8.0	0.6	20.0	300	0.56	0.10	0.03	0.20	0.18	0.04	4.0	370	0.30	0.60	0.01	0.01	0.09	0.35	13	—	—
Blood Meal, flash dried	91.0	85.0	1.6	1.0	1400	0.30	0.22	0.20	0.09	0.32	0.27	4.4	440	3.00	7.60	1.00	1.40	1.10	3.90	38	—	—
Brewers Dried Grains	93.0	27.0	7.5	12.0	1000	0.27	0.66	0.18	0.08	0.25	0.12	4.6	960	1.30	0.90	0.57	0.39	0.40	1.00	20	—	—
Canola Meal	92.5	38.0	3.8	11.0	960	0.70	1.17	0.30	1.30	0.05	0.06	7.2	3042	2.30	2.30	0.68	0.47	0.44	1.70	25	—	—
Coconut Meal, Mech	93.0	21.5	5.8	12.0	680	0.15	0.60	0.20	1.85	0.04	0.03	6.9	510	2.30	0.55	0.33	0.20	0.20	0.60	27	—	—
Corn Germ Meal (wet milled)	93.0	20.0	1.0	12.0	770	0.30	0.50	0.16	0.34	0.04	0.10	3.8	800	1.30	0.90	0.57	0.40	0.18	1.10	26	—	—
Corn, yellow	86.0	7.9	3.8	1.9	1560	0.02	0.25	0.08	0.31	0.03	0.04	1.1	250	0.36	0.26	0.20	0.18	0.07	0.26	39	1.9	10.0
Corn, yellow (hi-oil)	86.0	8.2	6.0	1.9	1625	0.02	0.26	0.09	0.31	0.03	0.04	1.2	250	0.40	0.28	0.20	0.19	0.07	0.30	40	3.0	10.0
Corn Glutten Feed	90.0	22.0	2.1	10.0	800	0.20	0.80	0.21	0.60	0.14	0.20	7.8	1100	1.30	0.45	0.20	0.50	0.10	0.80	30	1.0	10.0
Corn Glutten Meal, 60%	90.0	62.0	2.0	2.0	1690	0.02	0.50	0.18	0.45	0.03	0.06	1.5	1000	1.90	1.00	1.90	1.10	0.26	2.00	34	1.0	140.0
Cottonseed Meal, expeller	91.0	41.0	3.9	12.5	1000	0.15	0.93	0.28	1.25	0.04	0.04	6.2	1270	4.30	1.60	0.50	0.59	0.50	1.35	37	1.2	—
Cottonseed Meal, solvent	90.5	41.0	0.8	12.4	900	0.15	0.98	0.28	1.26	0.04	0.04	6.4	1300	4.60	1.70	0.46	0.62	0.45	1.35	40	0.4	—
Crab Meal	93.0	31.0	1.8	14.0	750	16.00	1.50	1.50	0.80	0.88	1.51	30.8	920	1.70	1.40	0.50	0.20	0.30	1.00	26	—	—
Distillers Dried Grains w/solubles	91.0	28.0	8.0	8.0	1090	0.27	0.77	0.34	0.86	0.55	0.17	4.5	1780	1.00	0.80	0.45	0.50	0.20	1.00	25	4.0	1.0
Fat, animal (stabilized)	98.0	—	95.0	—	3700	—	—	—	—	—	—	—	—	—	—	—	—	—	—	54	—	—
Fat, feed (vegetable/animal blend)	98.0	—	95.0	—	3800	—	—	—	—	—	—	—	—	—	—	—	—	—	—	55	20.0	—
Fat, poultry	98.0	—	96.0	—	3850	—	—	—	—	—	—	—	—	—	—	—	—	—	—	55	20.5	—
Fat or Oil, vegetable	98.0	—	96.0	—	4000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	52	38.0	—
Feather Meal	92.0	85.0	2.5	1.5	1050	0.20	0.70	0.70	0.30	0.70	0.28	3.7	400	3.90	1.05	0.55	4.00	0.37	3.00	34	—	—
Fish Meal (Anchovy) 65%	92.0	65.0	10.0	1.0	1290	4.00	2.80	2.80	0.74	0.87	1.00	15.0	2200	3.60	4.80	1.90	0.60	0.70	2.80	35	—	—
Fish Meal (Menhaden) 60%	92.0	62.0	9.5	1.0	1340	5.00	2.90	2.90	0.73	0.59	0.60	19.6	1400	3.60	4.80	1.70	0.50	0.55	2.86	35	—	—
Fish Solubles (50% solids)	51.0	31.0	4.5	0.5	870	0.10	0.49	0.49	1.48	1.00	1.70	9.4	1800	1.30	1.47	0.44	0.20	0.11	0.60	—	—	—
Hominy Feed, yellow	90.0	11.5	6.0	5.6	1360	0.04	0.50	0.17	0.63	0.08	0.05	2.7	630	0.55	0.44	0.22	0.13	0.12	0.40	26	—	1.5
Meat & Bone Meal 50%	94.0	50.0	9.5	2.8	1075	9.70	4.40	4.40	0.46	0.72	0.84	32.0	870	3.40	2.50	0.65	0.35	0.29	1.70	37	—	—
Molasses, cane	75.0	3.0	0.0	0.0	890	0.90	0.05	0.02	2.38	0.16	2.00	8.0	400	—	—	—	—	—	—	88	—	—
Oats	89.0	11.5	4.0	11.0	1150	0.10	0.35	0.10	0.42	0.08	0.10	3.2	425	0.80	0.38	0.18	0.20	0.14	0.30	20	—	—
Peanut Meal, hydraulic or expeller	92.0	45.0	5.2	12.0	1050	0.15	0.55	0.20	1.12	0.08	0.03	5.7	700	4.80	1.60	0.41	0.70	0.46	1.40	29	—	—
Poultry By-Product Meal	93.0	60.0	13.0	2.0	1325	3.60	1.90	1.90	0.55	0.28	0.54	1.77	2720	3.80	2.55	1.00	1.00	0.50	2.00	35	—	—
Rice (broken)	89.0	7.3	1.4	8.0	1340	0.04	0.24	0.10	0.13	0.04	0.06	4.5	400	0.56	0.16	0.14	0.10	0.12	0.25	34	—	—
Rice Bran, unextracted	89.0	12.5	15.5	11.0	1175	0.06	1.60	0.16	1.50	0.05	0.06	5.0	515	0.95	0.55	0.21	0.21	0.13	0.43	30	3.0	—
Rice Bran, solvent	90.0	14.0	1.0	13.5	660	0.10	1.40	0.15	1.34	0.04	0.06	11.1	520	1.00	0.60	0.30	0.30	0.14	0.40	21	—	—
Rice Polishings	90.0	12.0	12.0	5.0	1400	0.05	1.20	0.20	0.02	0.17	0.15	9.0	600	0.90	0.60	0.25	0.26	0.10	0.36	26	3.0	—
Sorghum	89.0	9.8	2.8	2.0	1500	0.04	0.30	0.10	0.35	0.03	0.06	1.8	300	0.36	0.27	0.12	0.18	0.10	0.30	34	—	—
Soybean Hulls	90.0	11.0	1.9	36.5	668	0.40	0.19	0.04	1.16	0.01	0.01	4.5	223	0.89	0.66	0.14	0.17	0.17	0.50	20	—	—
Soybean Meal, solvent	90.0	45.0	0.8	6.5	1020	0.25	0.60	0.20	1.92	0.04	0.03	5.8	1245	3.20	2.85	0.65	0.67	0.60	1.70	37	—	—
Soybean Meal, dehulled	90.0	48.5	1.0	3.0	1100	0.20	0.65	0.20	2.05	0.04	0.05	5.8	1295	3.60	3.05	0.70	0.71	0.66	2.00	40	—	—
Sunflower Meal Solvent	90.0	34.0	1.0	13.0	1000	0.30	1.25	0.26	1.60	0.20	0.21	7.0	850	2.80	1.40	0.60	0.55	0.35	1.45	31	—	—
Wheat, hard	89.0	12.5	1.7	2.9	1450	0.05	0.38	0.15	0.45	0.06	0.07	2.1	390	0.62	0.39	0.24	0.26	0.16	0.36	39	—	—
Wheat, soft, western	89.0	10.5	1.8	2.6	1455	0.05	0.30	0.12	0.39	0.06	0.07	1.8	395	0.45	0.30	0.15	0.21	0.12	0.28	38	—	—
Wheat Bran	89.0	15.0	3.5	11.0	590	0.12	1.15	0.40	1.23	0.06	0.07	6.1	445	1.05	0.57	0.18	0.30	0.27	0.50	18	—	—
Wheat Middlings, flour	89.0	16.0	4.0	6.0	1150	0.10	0.66	0.18	0.89	0.06	0.05	7.8	430	1.00	0.80	0.20	0.26	0.22	0.49	20	—	—
Wheat Middlings, standard	89.0	15.5	3.6	8.5	940	0.14	0.88	0.23	0.59	0.06	0.07	5.4	480	1.10	0.70	0.16	0.20	0.20	0.50	21	—	—

1. Formula nutrient profile recommendations (page 14) are based on calculations utilizing these ingredient nutrient values.

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