SOUTH AFRICAN POULTRY ASSOCIATION
SUID-AFRIKAANSE PLUIMVEEVERENIGING

Learning Module 5

COMMERCIAL LAYERS

Table of Contents

MANAGE COMMERCIAL LAYERS

Introduction

The intention with this booklet is to discuss management aspects from the arrival of point-of-lay pullets and during production. The emphasis throughout the discussion will be to try and give information to enable the reader why certain management practices are in place.

Receiving and housing point-of-lay pullets at 16 / 17 weeks of age

Removal from crates and placement in cages / on the floor.	Handle with care, avoid jerking and injury. Avoid fractures to wing and leg bones; the healing puts stress on the bird and nutrients are used to heal damaged tissue.
Access to feed and water as soon as possible.	Birds are still in a growth phase and forming muscles and internal organs. Reproductive organs enlarge and liver is forming yolk for deposition in ovary. A few birds already in lay and forming egg shells.
Avoid as far as possible the factors that cause stress: Exposure to sun, rain, wind, banging of trolleys, absence of feed and water.	Stress is a condition in which the brain stimulates muscles to contract. Glucose levels become low and not enough energy is available for panting, to shiver or move to water and feeder lines.
Obeying stocking density figures.	Overcrowding of cages or floor space causes production drops. There is a code of practice for cage and floor densities to which farmers have undertaken to obey for welfare reasons.
Safeguarding of documentation received from the pullet rearing company: 1. Light programs 2. Vaccination program during rearing (This column continues on the next page)	1. Light program. The pullets have to be placed under an increasing pattern of light (photoperiods increasing[1]) to stimulate egg production. Layers subjected to a decreasing photoperiod (the number of light hours decrease) will start losing feathers and go out of production. The setting of time switches for a particular flock is therefore part of the documentation and must be displayed in the laying house. 2. Vaccination program during rearing. This important information enables the veterinarian to decide on a vaccination program for the new flock when there is disease outbreak in a nearby area. Especially if the new flock had not been vaccinated for that particular strain of the virus.

[1] Such as after the winter the days get longer and longer.

Receiving and housing point-of-lay pullets, continued.

Safeguarding of documentation from the pullet rearing company: 3. Growth and uniformity figurers	3. Growth and uniformity figures. The values on body mass give an indication of how well the pullets developed during rearing and achieved the target weights according to the standards for the breed. The figure for uniformity, the so-called CV, coefficient of variation, gives an indication of the spread around the average weight of the birds. In other words a low CV, say 8% would mean that there are not a large number of very light or very heavy birds, they are grouped closely around the average weight, the majority of the birds are on the same level of development and that a high figure during peak production could then be expected.
4. Production graphs	The graphs from the pullet grower give an indication of the potential production of the particular breed at a particular age. One will thus know whether the hens are performing better or worse than what they are capable of doing. The same applies for egg weight[2], feed intake and mortality figures. Egg size at a certain age is largely determined by a particular breed. However, the number of eggs that a hen will produce depends on management factors such as availability and quality of feed, house temperature and health of the hen.

The effect of environmental temperatures on laying hens.

The ideal temperature range of the environment for layers is between 18 – 24°C.
Within a temperature range of 18 – 24 °C the hen is able to maintain a constant body temperature without applying processes such as shivering to increase heat production because of cold conditions or to lose heat by means of panting because of very hot conditions.

The effect of temperature conditions outside the ideal: cold conditions.

During cold conditions the hen will lose more heat to the surrounding air than what is being produced inside the body by the many metabolic reactions associated with the life processes.
This will result in shivering (muscle contractions) and the energy (from the feed) is obtained from glucose and those reactions are accompanied with heat production.
Feed intake is always higher in winter than in summer.

[2] Egg sizes are according the following weights in grams: medium 43 - 50; large 51 - 59; extra-large 60 - 67; jumbo more than 68.

The effect temperature conditions outside the ideal: Very hot conditions.

During hot conditions the hen will not be able to lose sufficient heat to the surrounding air. It means more heat is produced than what is being be given off to the environment.

This causes an increase in body temperature and the brain reacts to depress appetite so that the digestive processes (muscle contractions) will not add additional heat to the body.

Hens start to pant to cool themselves by means of evaporation of moisture from the moist surfaces the inside of the respiratory tract.

Ventilation of laying houses

Purpose of ventilation, the four functions:

1. Removal of heat produced by the hens.
2. Removal of moisture produced by the hens and leaking water lines.
3. Removal of ammonia from the excreta.
4. Removal of dust from feed and bedding.

Removal of heat produced by hens, the first function of ventilation.

Origin of heat: Due to the many chemical processes occurring in the body, eg.

- Respiration and pumping of blood.
- Formation of the components of eggs.
- Digestion of feed.
- Replacement of worn tissue.
- Activity associated with movements to feed and drink etc.

Heat from the hens is passed on to the surrounding air in the building provided that the air temperature is much lower than 42°C, the hen's body temperature. Warm air is ventilated and replaced with cool air and the hens will be comfortable.

At outside air temperatures of 35°C the flow of heat from the hen to air at that temperature will be slow and hens will be panting to cool themselves by means of evaporation of moisture from the respiratory tract.

Increasing ventilation rate with air at 35°C will not have a cooling effect, cooling can only be achieved by pulling air through wet cooling pads and ventilating with air at a lower temperature than 35°C. (The factors affecting efficiency of cooling pads and panting will be the topic for a later discussion).

Removal of moisture produced by hens, the second function of ventilation.

Origen of moisture in the laying house.

1. From the urinary system.

Large amounts of water are used by the kidneys to flush uric acid out of the body by means of the kidney tubes. Uric acid (the white substance in excreta) is formed during the metabolic processes that occur in the body and because it is insoluble in water it has to be moved in a stream of water

almost like washing sand from a pavement. (Excretion of water by a hen is close to 100ml/day.)

2. From the digestive system.

Poultry are unable to digest fibre, such as in bran or the hulls of sunflower oil cake meal. Such indigestible material can only be expelled out of the digestive tract when it contains a lot of moisture. (Excretion of water close to 50 ml/day.)

Water changes to vapour and is taken up into the air

Removal of moisture from the laying house.

Moisture from the two aforementioned sources, and leaking water lines can be added, can only be removed from a building by means of ventilation. The water has to evaporate, become a vapour and taken up into the inside air of the building, and then ventilated. Evaporation is illustrated by boiling water that changes to steam, (vapour) and is taken up into the air, picture on the right.

During warm weather and low humidity in the air, evaporation will take place and bedding and manure under cages will dry out.
However, during winter the capacity of air to hold moisture is limited and wet bedding becomes a huge problem. In buildings equipped with temperature and timer switches that will stop the fans during the night to allow the temperature to increase and the moisture to evaporate before switching on again, is a procedure that can be used to remove moisture from bedding and manure. The setting of curtains to allow the inside temperature to increase so that moisture from bedding material can evaporate and ventilated, takes a lot of dedication and experimentation to succeed. There is no solution for condensation of moisture against a corrugated iron or asbestos roof except to have ceilings installed. In free-range houses the removal of wet spots and the turning of bedding to expose the underlying material to the air so that evaporate can take place, is the only way of controlling the moisture content in bedding material.
For all housing systems the management of the drinker lines is most important, all leaks have to be fixed with minimum delay.

3. From the respiratory system.

The water the hen excretes is by means of the respiratory system in the form of water vapour. Under normal conditions it will amount to 40 ml/day but during high temperatures when panting, it will most probably be twice that value. Under such conditions the hens are thus adding additional moisture to the air inside buildings where cooling pads are used in summer.

Removal of ammonia: the third function of ventilation

Origin of ammonia:

Ammonia is a gas that is formed by bacterial action on uric acid excreted by the hen.
Ammonia causes the degeneration of the inner linings of the respiratory tract and thus makes it easy for bacteria to infect the respiratory tract. High levels of ammonia also cause a drop in egg production. **Control of ammonia is to control the moisture content in litter under the cages or in the bedding material**.

Removal of dust by means of ventilation: The fourth function of ventilation

Origin of dust:

Dust in laying houses originates from the feed and from dry bedding in free-range houses.
It is important to control dust as it is a carrier of disease causing organisms as well as a contaminant on eggs. In houses with fans ventilation will remove a lot of the dust provided that inlets and fan blades are clean and fan belts are tight enough to prevent slipping.

Principles of air flow in poultry houses

1. Open-sided houses (Naturally ventilated houses)

Wind that blows against the building forces the air into and through the building. The size of the opening of the curtains or the flaps determines the amount of air that flows through the building and these are adjusted according to prevailing wind and temperature conditions.

Cold conditions:

Hens are able to withstand temperatures as low as 5°C without difficulty but that puts some stress on their energy reserves as they will shiver to maintain a constant body temperature. Increases in feed intake during cold weather is an attempt to obtain energy to maintain their body temperature. Regular visits during such conditions are important to ensure bird comfort.

Hot conditions:

To alleviate adverse conditions, roof sprayers will help and should be turned on long before midday. The evaporation of water from the roof cools the asbestos or iron roof and makes a big difference to the inside temperature of the building.
High pressure mist sprayers, sometimes in combination with circulation fans from the roof, will also make a big difference to the inside temperature on hot days. It is most important that when using such sprayers to be certain that some air movement due do a breeze is taking place and that there is no built-up of humidity in the inside air. Mist sprayers on a timer switch can cause a built-up of humidity, a constant evaluation of the situation is necessary to switch sprayers off in time before humidity gets too high, for example more than 65%.
The pump supplying the mist must be in good working condition and that the size of the droplets is such that they evaporate within seconds. Water must not drop onto the floor, as that will result in catastrophic high humidity and high mortalities.

2. Closed houses: Mechanically ventilated layer houses

Fans are used to create an area of low pressure where it blows the air out of the building at one end and the air enters through louvers along the side walls or through inlets at the other end of the building, the so-called tunnel ventilation system.
Factors determining success:
1. Air speed at inlets. The air has to enter the building at high speed (2.5 meter per second) to ensure proper turbulence and mixing of the air. For a certain volume of air that is being moved by the fans, air speed through a louver will increase when the size of the opening is decreased.
It means that when more fans come on all louver openings must adjust to a make the opening larger in order to ensure that wind speed remains the same. The main problem with low air speeds is,

especially during winter, is that the air does not mix with inside air but drops to the floor causing cold, and wet, spots in those areas.

2. Air leaks should be sealed to ensure that wind speed passing through the louvers is the same for all and that no short circuiting of air takes place. Air takes the shortest route to the extractor fans.

3. Mechanical condition of the equipment. Maintenance is most important, fan blades and inlets that have accumulated dust decrease wind speed, fan belts that are not tight enough will slip and fans will deliver less air, louvers that are sticky or remain open will cause uneven distribution of air.

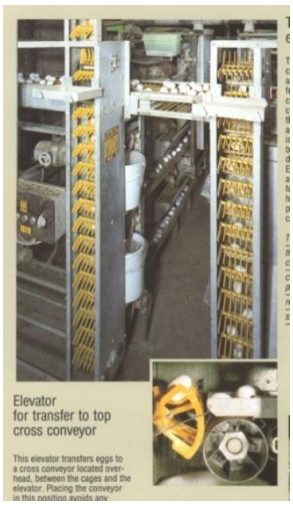


Figure 1 Battery cage system with automatic egg collection belts running in front of cages and end collection

Evaporative cooling of mechanically ventilated laying houses

1. The principle of evaporative cooling is that when water evaporates, cooling takes place. The proof of this statement is that the temperature of water in a boiling kettle remains the same as long as the kettle contains water, thus heat was taken up from the water and no temperature increase occurred. When air is drawn though a wet pad, evaporation of water takes place and heat was removed from the air. The surface of the pad is cooled and so also the air moving through the pad.
The temperature of the water is not important, cooling occurs because the water changes from a liquid to a vapour.

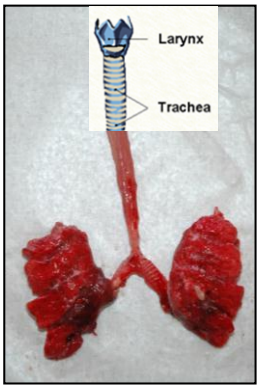
2. The decrease in air temperature is determined by the amount of water that is present in the air before going through the cooling pad. If the air already contains a lot of moisture, it is obvious that not a lot of water will evaporate and the cooling effect will only be one or two degrees. However if the air is dry, in other words of low moisture content, the cooling effect will be much greater, for example six to eight degrees.

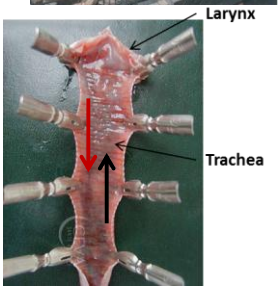
Evaporative cooling: the mechanism of cooling when hens pant

Hens will start panting at air temperatures of 28 – 30 °C.

The air inhaled during panting cause evaporation of moisture from the wet membranes lining the mouth cavity and upper regions of the respiratory tract. This results in cooling of the blood flowing through these membranes and the cooled blood that returns to the inner body cools those tissues. This enables the hen to maintain a constant body temperature.

Windpipe (trachea) and lungs





When inhaling air (red arrow) evaporation of moisture takes place on the wet inner surface of the trachea.
Blood in contact with the trachea is cooled and returns to body tissues and cools the bird.
Black arrow shows air leaving the body.

The very same principle applies as was mentioned in paragraph 0, item 2, namely that the decrease in temperature will be determined by the amount of water present in the air inhaled by the hen.
If the air already contains a lot of moisture, not a lot of water will evaporate and the cooling effect will only be one or two degrees. However if the air is dry, in other words of low moisture content, the cooling effect will be much greater, for example six to eight degrees.
Inside the laying house when evaporative cooling is on, the air inhaled by the hens is high in moisture content and evaporation from the membranes in the respiratory tract is low and very little cooling takes place. That is why it is important to switch the mist sprayers off when humidity inside the building becomes high, say more than 65%.

Effect of environmental temperature on feed intake

Effect of low temperatures

During low temperatures, for example 15°C, the hens will be losing more heat than what is produced by the normal metabolic processes inside the body. The brain will react and will "*tell*" the muscles to start shivering. Shivering is a process of muscle contraction and like all actions of muscle contraction it requires energy to take place and as you know, in all processes the utilization of energy is accompanied with heat production and that enables the hen to maintain a normal body temperature of 42°C. (Hens increase their feed intake during low environmental temperatures to obtain energy for shivering).

Effect of high environmental temperature on feed intake

The muscle contractions by which feed is propelled through the digestive tract and by which undigested feed residues are transported require energy and are thus accompanied with heat

production. During high temperatures the hen has already difficulty to maintain a normal body temperature and the brain senses the additional heat load and "tells" the hen not to eat by suppressing her appetite. The decrease in feed intake causes a drop in production as well as a drop in egg shell quality due to the lower calcium intake. In an attempt to prevent poor shell quality additional shell grit or limestone grit is occasionally added into the feed troughs.
It has been found that chilled or cool drinking water has a beneficial effect to alleviate heat stress; flushing the water lines a few times during hot days is also beneficial.

The provision and maintenance of drinking water for layers

Functions of water

Water[3] is one of the most important chemical compounds[4] in the animal body. Poultry can survive much longer without feed than without water. Only a few hours without water causes serious changes within the body that will have a marked reduction in growth rate and health of growing chickens and in hens it can result in a drop in egg production and the birds might go into a molt (lose feathers). If feed is withheld poultry can lose 40% of their body weight and still stay alive whereas the loss of only 10% in body water causes serious disorders and death occurs when 20% of the water in the body is lost.

Water is essential for the passage of feed into and through the digestive tract and the excretion of indigestible material. Picture of a chicken that was deprived of water shows that no movement of feed took place. Water is the medium for the digestion of feed. The chemical reactions between the digestive enzymes to break down the proteins, starch and fat in feed into their simplest components, the nutrients such as amino acids and glucose can only take place in a watery medium. Absorption of nutrients into the blood stream can only take place in a watery medium.

Water is the main substance of mucus secreted by the linings of the mouth and oesophagus. In the absence of water the feed cannot pass from the crop to the rest of the gastrointestinal tract to be digested.

Water plays a most important role during high temperatures to enable the bird to lose heat by means of panting. Without evaporative heat loss the bird will probably not be able to survive temperatures of 35 °C. (Panting starts at environmental temperatures of ±30°C.)

Water is essential for the excretion of uric acid. Uric acid is the end product of protein metabolism in the body and it is a highly insoluble product. It means it has to be transported from the kidneys to the cloaca in a *stream* of water, almost like flushing sand. When birds are deprived of water the uric acid crystals accumulate in kidney tubes with rupturing of tubes when water is provided and causing instant death.

Water is an essential component of an egg. A 50g egg contains 33g of water and a water shortage

[3] Scott, M.L., Nesheim, M.C. and Young, R.J. 1969. Nutrition of the Chicken. Humphrey Press, Geneva, New York.

[4] *Chemical compound* is a phrase often used by writers to describe any substance in pure form fulfilling a certain function, for example glucose or table salt can be termed chemical compounds

causes an immediate drop in egg production.

Water management

Layers under normal circumstances would drink twice the amount of water than the weight of feed they consume, approximately 220 ml per day. Impurities in water such as high salt content or toxins from biofilms in water lines can thus have a very large effect on bird health and production.

Biofilms are colonies of bacteria that grow inside the water lines and produce poisonous substances that depress the digestive processes and egg production. When houses have been depopulated water lines should to be cleaned with the recommended product at the correct concentration and procedure. This operation forms an important part of the bio-security program on the farm.

Water filters should be cleaned at recommended periods of time to ensure that solid particles are not blocking the flow of water through the pipe line and depriving hens of sufficient drinking water. Taking of water samples must be done at the end of the supply line from which the birds are drinking as this can give an indication of impurities like bio-films inside the pipe. Sampling should not be done from one of the water taps outside the building as this might not be the supply line to drinkers.
For the analysis of water quality it is necessary to collect a 2 litre sample from more than one locality into clean containers and samples should be delivered within 6 hours to the laboratory. Needless to say samples should be clearly marked with a water resistant ink on the container.

Water consumption is as important, if not more important, than feed consumption figures. Abnormal high levels of water consumption can be an early warning of a disease condition. Water intake increases and feed intake decreases when birds are becoming ill and show signs of scouring (diarrhoea and high excretion of urine).

Water meter readings should always be taken at the same time of the day and plotted on a graph to make interpretation of trends easy.
The signs of water deprivation: a When the water supply has been turned off accidentally to a row of cages (this happens when drinkers were repaired and it was forgotten to open the stop valve again) the birds will peck at the dry water nipples or drinkers. The next sign is the dry appearance of excreta with very little urine excreted. The feed trough will also show no signs of feed being consumed. The combs of the hens start turning blue and production stops in cages that are without water. A final sign of water deprivation will be when shedding of feathers occur. Production will resume 10 days or more after water had been provided.

Feeding programs for layers

Feed cost is 70% of the production cost of eggs. It thus means that if it costs R1.00 to produce six eggs the cost of feed alone amounts to 70 cents, all other expenses such as electricity, packaging material, vaccines, salaries of staff is only 30 cents. Feed wastage or any factor affecting the hen that she skips a day and not laying an egg will have a big influence on the cost of production process and profitability of the operation. (When an operation is no longer profitable it will close down.)
Feeding the young pullet into production. The quantity of feed the young pullet is able to consume (± 85g per day) is limited by crop size and therefore the concentration of nutrients in the feed of young birds is normally higher than in diets for older layers. The feed supplier will formulate a feed

according to the daily feed intake level and assign a code to the feed which is normally an indication for recommended intake to enable the pullet to grow into maturity and at the same time be able to form an egg.

Importance of accurate feed records

1. The feed company includes the various nutrients such as calcium or energy to supply in the needs of the hens at a particular age and level of production. It is, however, important to enable the manager to give accurate feed-back on consumption figures so that the nutritionist at the feed mill will be able to evaluate whether the hens are not being underfed nor overfed.
2. Feed records are essential to be able to calculate the quantity of feed the hens are consuming to produce one kilogram of eggs. When such figures are way above the norm it would be necessary to find reasons for such deviations: for example wastage of feed, conditions of low temperatures in the laying house or a low level of disease that depresses egg production.

3. Presence of poisonous substances in feed will result in a depression of appetite and lowering in production and such problems can only be detected with accurate feed records. Mould growth in leaking feed bins or in feed troughs because of some birds regurgitating onto the feed, will depress production.
4. Detection of the depression of production due to the consumption of unbalanced diets and uneaten feed. The daily 'turning' of feed in the troughs ensures that wet lumps are loosened and that the fines (the vitamins and the micro-minerals) in the feed are also consumed. The feeding times on the programmer for the feed chains should be programmed to operate four to six times per day to ensure that feed is always available but that the feed levels in troughs are not too high and the essential nutrients are not being consumed. Hens prefer to consume the coarse and granular fractions first and to leave the fines in the trough.

Receiving feed deliveries

1. It is important that the person receiving a load of feed will be familiar with the colour of normal feed and of the structure of feed whether crumbs or mash. Abnormalities such as coarse salt, high levels of fibrous substances such as bran or pellets must be reported to the manager.
2. It is essential that a 10 kg sample of every new feed delivery will always be taken and properly marked with the delivery date and invoice number. In cases of disputes with the feed mill a sub-sample of the feed must be retained by the farmer and sealed in the presence of a police officer.

Light programs for layers

The supply of light to layers is one of the most powerful tools to ensure a constant level of production. Before the discovery of the effect of light on birds (some 80 years ago) egg production during autumn decreased and ultimately stopped during winter due to the decreases in hours of day-length. By supplying light to keep the day-length constant it became possible to have hens maintaining their level of egg production regardless of the time of the year.

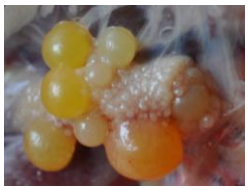
The mechanism by which light affects commercial layers

1. Light is a form of energy. It is capable to penetrate the skull of the hen and to stimulate the brain to secrete hormones. Hormones are chemical substances that stimulate the liver to produce yolk material for deposition in the ova[5] contained in the ovary.
2. The stimulatory effect of light on egg production is brought about by the pattern of lighting. Increases in the light period has the effect in young pullets to bring them into production and by maintaining the light period on a constant level of 14 - 16 hours per day, egg production is maintained on a high level throughout the year.
3. Layers should never be exposed to a declining light pattern or variations in light period during the production period. It is thus most important to check the time switches every morning to ensure that they are on time and according to the light program for a particular flock.

Egg formation and egg quality

Organs involved in egg formation of an egg: the ovary and the oviduct.

The ovary. The ovary is the organ that contains the reproductive cells of the hen, each within a follicle (a little bag) into which yolk material, formed by the liver, is deposited.



Prior to sexual maturity the ovary, on the right, is a mass of small follicles containing the germ cells (reproductive cells) of the hen. Several thousand are present in each female, which is many times more than the number that will eventually develop into full sized yolks in the eggs the hen will lay during her lifetime.

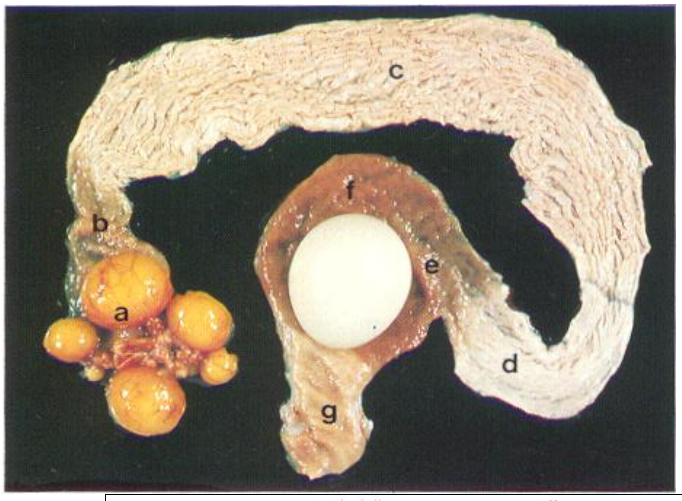
The ovary, marked a, in the picture, contains the ova, the reproductive cells of the hen, *yolks* in popular language.

The opening of the oviduct, b, surrounds an ovum which will be taken up into the oviduct, c, after its release from the ovary.

During passage of the ovum through the oviduct, albumen is secreted around the ovum, section c. Shell membranes are then formed in section d, to cover the newly formed egg mass. Calcium carbonate is secreted in sections e and f to form the shell.

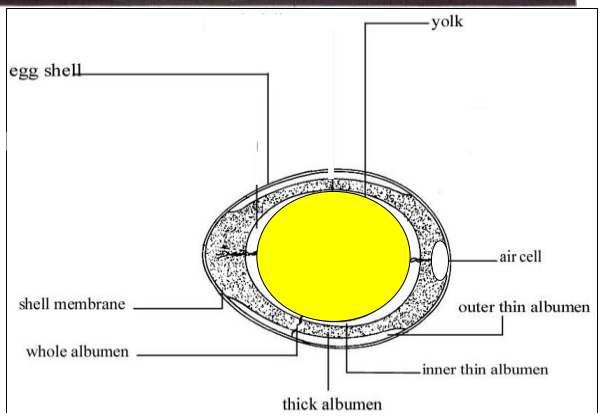
[5] Ova are the reproductive cells of the hen

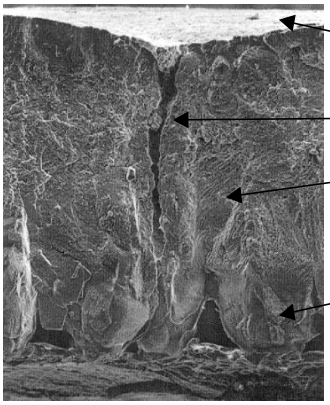
In everyday language the word “yolk” refers to the ovum. However, yolk is actually the yellow material in the ovum and it consists of fats, proteins, minerals and some water. Yolk is so commonly used that the reader must just keep in mind that yolk is a misnomer for the ovum. The colour of the yolk! is used an indication of egg quality, heading, 0.



The contents of an egg consist of egg yolk, two layers of thin albumen, and the layer of thick albumen, generally known as the white of an egg.

The layer of thick albumen is used as an indication of the quality of an egg, discussion on this is a separate topic. Also take note of the air cell at the blunt end of the egg which is a rough indication of the age of an egg.

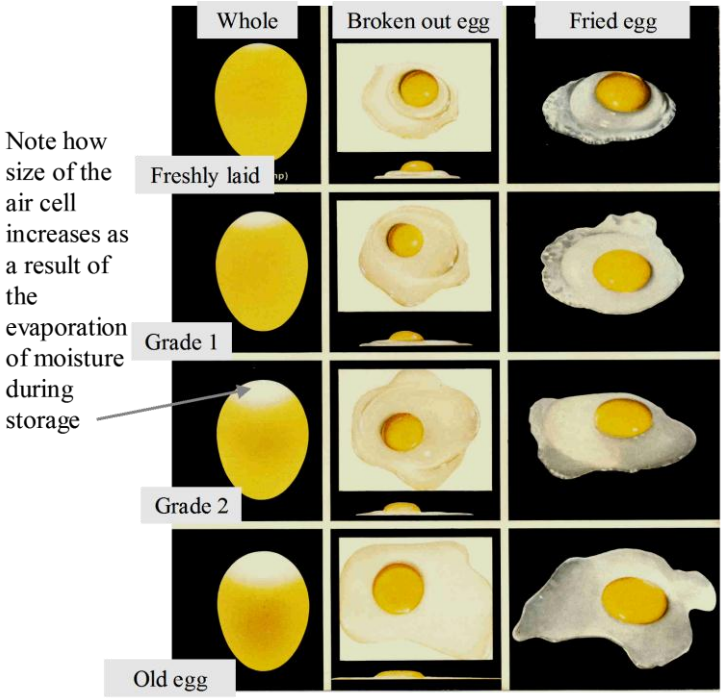




The section through the shell shows the cuticle, it is a waxy coating to prevent bacteria to penetrate the egg contents through the pores. You will also note that the shell consist of two layers of calcium, the mammillary layer surrounding the shell membrane and the upper palisade layer which forms the largest portion of the shell.

Internal characteristics of eggs: Albumen height and yolk colour

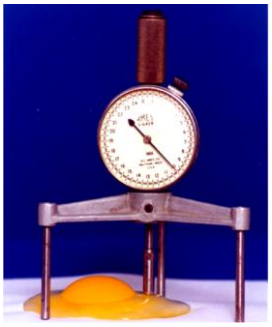
The height of the thick albumen is generally used as indication of internal egg quality



In the freshly laid fried egg the thick white (albumen) stands out and has clearly a firm jelly-like appearance. The albumen of the Grade 1 egg still shows some firmness but not to the same extent as in the freshly laid egg. The thick albumen starts to become more fluid and in the so-called old egg the albumen clearly has a watery appearance

It is thus mainly the height of the albumen (egg white) that declines with age.

The height (firmness) of the thick albumen is used as a characteristic of quality and is expressed in Haugh units. A Haugh unit takes into account the weight of an egg as well as the height of the albumen. The height of the albumen from a flat surface is measured with a micro-meter mounted on a tripod as shown in the picture.



During storage of eggs, especially under high environmental temperatures, the albumen becomes watery very rapidly and that results in a low Haugh unit value. This can happen within two days after an egg is laid, it can thus by far not be described as an *old egg*. The recommended[6] storage temperature for eggs is 12 – 15 °C and a relative humidity of 70 – 80%.

The yolk colour is also used as indication of internal egg quality

Yolk colour has been standardised by the "Roche" colour fan, which is a set of yellow coloured blades varying from a very light yellow (number 1 on the fan) to a dark or almost reddish yellow (no 14) and values between 10 to 12 are acceptable. Yellow maize is the main source of pigments for yolk colouring. Layers on free-range would have a much higher level of the yellow pigments in their egg yolks due to the pasture to which they also have access to. Yellow pigments are covered with the green chlorophyll in leaves and therefore not visible.

[6] Egg quality handbook. Queensland Dept of Primary Industries, Q190014.

Abnormalities of internal egg contents

Blood and meat spots. These originate from the membrane surrounding the ovum. When this membrane rips open to free a fully developed ovum a fragment of tissue or a blood spot is included with the ovum in an egg. These are often mistaken for an *embryo* by a customer.

Double yolked eggs. At the onset of production when a flock of pullets come into production a higher number of double yolked eggs will be noticeable. This is because of unstable levels of hormones that have been involved in the stimulation of sexual maturity and had caused more than one ovum in the ovary to be ovulated, the ovums come free simultaneously. The situation reaches normality once the birds' metabolic systems have settled down. More often is the cause of double yolked eggs a light program that was increased too rapidly. It also occurs where young pullets are placed with older hens in the same building in which the light program is already at the maximum number of hours, for example 16 hours.

Bacterial and fungal contamination of eggs.

The greatest threat to internal contamination of eggs by bacteria is from the persons collecting the eggs and handling eggs during packing. *Salmonella enteritidis* is a bacterium that can be transmitted from human carriers to eggs and equipment. This bacterium causes diarrhoea in humans and it is most important that persons handling eggs should be aware of the importance to wash their hands after they have been to a toilet. Soap that contains a disinfectant and paper towels should be available in all toilets and rest rooms on an egg farm.

Other routes of contamination:

- The cloaca, if hens are suffering from scouring (diarrhoea).
- Egg collection belts, packing material and nests contaminated with faecal and egg contents from broken eggs.
- Poor handling during egg collection results in hairline cracks causing easy penetration and access for bacteria to egg contents.
- **Poor environmental conditions, such as dirty equipment, floors, clothing of workers, rodents, and cockroaches etc.**

External quality characteristics of eggs

Factors affecting shell defects (Such eggs cannot be marketed)

Age of the bird: Shell thickness decreases with age because hens have lower calcium reserves and eggs from older hens should thus be handled with more care that eggs from younger hens.

Shell strength is related to the thickness of the shell. Shell thickness is typical to particular a breed.

High environmental temperatures lead to decreases in eggshell strength probably because of lower feed (calcium) intake during hot weather.

Diseases such as EDS (egg drop syndrome) affect shell quality, picture on the right.

Picture on the left show shells are dented and/or have thin shells and albumen is watery due to Infectious bronchitis, IB.

Factors affecting the appearance of egg shells (Not marketable)

Cleanliness of the shell.

It is a most important aspect from the consumer's point of view that eggs will be clean without adhering dust or faecal matter. Dirty cage floors, egg collection belts, dirty nest material, used egg trays, hands that handle eggs can all contribute towards eggshells being contaminated with dirt (Washing of eggs removes the waxy layer and spoilage bacteria that can be drawn into the egg to cause rot).

Stained shells and fly marks.

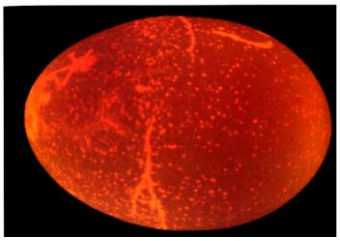
Staining on the shell surface could be as a result of various substances such as blood caused by prolapsing, faeces and contamination from broken egg matter.

Open cracks

Are associated with the shell membranes being damaged or broken. The careless stacking of egg trays and the handling during collection all cause damage to the shell.

Hairline cracks, (left)

Are very fine cracks that are only detectable by candling[7]. Main causes are rough handling during collection.



Pinholes, (right)

Are very small holes in the shell. Older flocks, poor nutrition and sharp objects in the cage system could be the possible causes.

[7] Candling is the process whereby eggs move over a strong light to enable the detection of shell defects

Diseases that affect layers in cages and on free-range systems.

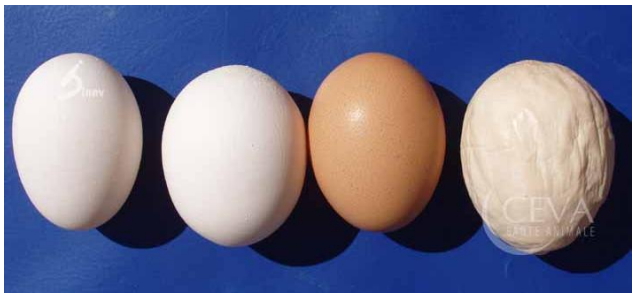
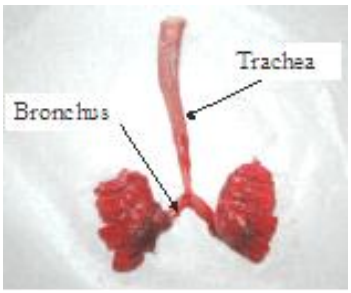
Diseases caused by viruses

New-Castle disease.

There are three forms of New-Castle disease: the mild form that causes low mortalities but a decrease in egg production, a second form that is more severe and the third form that causes a very high mortality, up to 80% of the flock gets infected. Symptoms are watery nostrils, gasping, trembling, egg shells vary in colour and twisting of the neck. In some cases the inner lining of the stomach, the proventriculus, show blood spots in the tissue.



Infectious Bronchitis (IB). The bronchi[8], those tubes that connect the lungs with the respiratory tract (trachea) have been infected by the virus. Infections due to *E. coli* causes cheese-like material to accumulate in the bronchi, the bird has problems to breathe and show signs of gasping. Egg shells are rumpled and vary in colour.

Diseases caused by internal parasites

Coccidiosis

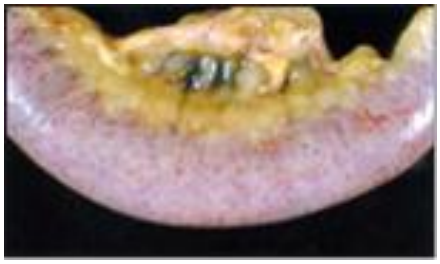
The causative organisms of coccidiosis are protozoa. The coccidia need favourable conditions of heat and moisture outside the body to become infective. The chances are thus slight for layers in cages to get infected.

When coccidia are consumed in the active form they will invade the intestinal wall causing large-scale damage to the tissue, visible from outside, and blood can also be seen in the excreta. Floor-reared pullets are thus vaccinated to make them immune against coccidiosis.

[8] One tube is a bronchus but more than one are called bronchi. Inside the lung many branches of the bronchi, called parabronchi, bring the air in contact with the lung tissue to enable the supply of oxygen to red blood cells

Intestinal parasites, worms

Adult worms in the intestinal tract produce eggs that are excreted with the droppings. After a period of 7 – 14 days outside the body the eggs have become infective and re-infection takes place. Worms damage the intestinal wall, compete with the hen for nutrients and cause blockage of the intestines. The control of worms is by means of inclusion of anti-worm preparations in the feed.



Apply bio-security programs on layer farms.

The purpose of bio-security is to prevent contact between layers and disease causing organisms

Means by which disease causing organisms can enter a layer farm:

1. People are the main transporters of disease-causing organisms onto a farm. Most people visiting poultry farms have had some previous contact or involvement with poultry or with people who deals with poultry.
2. It is most important not to allow visitors into poultry houses before they had gone through a shower and changed into clean clothes and shoes.
3. Wild birds are carriers of viruses that cause Newcastle disease, IB (infectious bronchitis), coryza and MG (mycoplasma gallisepticum) and MS (mycoplasma synovia). It is indeed not easy to keep wild birds out of laying houses but one should stop applying all possible means to achieve this. Nesting of wild birds on rafters and roof beams should not be tolerated.
4. Feed wastage at feed bins is especially bad and wild birds get to know feeding spots.
5. Rats and mice are carriers of a bacterium know as *Salmonellae enteritidis* and eggs that are contaminated with those organisms are not allowed to be marketed. Those organisms are difficult to control and cause diarrhoea in humans.

The role of sanitary conditions in a bio-security program:

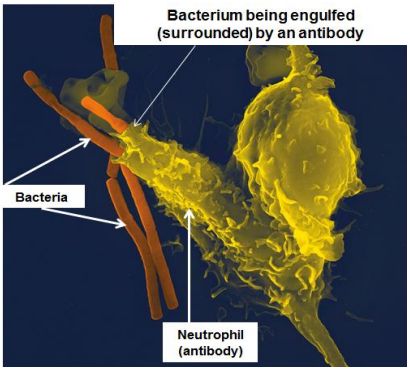
1. Sanitary conditions: This means cleanliness and the removal of waste, dust and material such as fats and oils in all working areas. These materials provide protection to bacteria and viruses, for example the Newcastle disease virus can survive for several weeks when protected against the sun and disinfectants.
2. Disposal of dead birds. These should be disposed of in a proper manner, for example incinerated or placed in mortality pits with tight fitting lids to keep flies out. Dead birds harbour viruses and bacteria.
3. Control of flies is most important and should take place at their breeding sites. Wet manure provides an excellent medium for flies to breed in and every effort should be made to prevent water leaks onto manure under the cages. Fly control on a layer farm is also most important to prevent fly marks on eggs.

Stimulation of immunity as measure to control disease

Purpose of vaccination is to stimulate immunity to control diseases

A vaccine contains the viruses of a disease in a weakened form. When these are given to the hens by means of a spray or in the drinking water, it stimulates the production of antibodies.
The most common route of administration by which the vaccine can enter the body is through the mucous membranes of the eyes or mouth and then into the blood stream (eg vaccines administered by means a spray or in the drinking water).
The circulating blood passes through organs[9] that have the ability to make antibodies against these bacteria or viruses. The antibodies are very specific for the agent that was used to make the vaccine: whether it was a mild or virulent form of New Castle disease virus, an IB or Gumboro virus etc. These antibodies then circulate in the blood stream and assist in protecting the cells of organs that will be invaded by the virus.

The antibodies recognize the virus strain that was used to make the vaccine and that means they will immediately attack that particular virus whenever it enters the blood stream in future. They make it harmless by binding to the virus. The accompanying picture shows the antibody that engulfs (covers) a bacterium present in the blood stream.
(Picture copied from Wikipedia, the free encyclopaedia)



Antibodies are proteins and thus not stable compounds. Their concentration (numbers per ml) decline over time and it might happen that they can be overwhelmed if large numbers of the virus invade the bird. Therefore layers have to be vaccinated with certain intervals to ensure that their antibodies remain on a level sufficiently high to protect the birds against diseases that are prevailing in an area.

The antibody level for a particular disease (also known as the titer count) is therefore a good indication of the degree of protection against that disease. Bear in mind that antibodies are produced specifically in response a particular virus strain, which means the strain that was used to make the vaccine. It does not protect against another strain of the virus or to viruses causing a different disease.

Vaccinating the layer flock: Important considerations

1. Health of the birds. Only healthy birds must be vaccinated. A vaccine contains the disease causing organism and it places a stress on a bird when those organisms are actually put into its body. In some instances birds would indeed show slight signs of the disease for which the vaccine is being applied. The formation of antibodies is poor in unhealthy birds and they are not well protected.

[9] Organs involved in the production of antibodies include the thymus, bursa of Fabricius, bone marrow, the spleen, Harderian gland, cecal tonsils, Peyer's patches in the intestinal tract and Meckel's diverticulum

2. Handling vaccines for spraying or aerosol:
3. Equipment must be clean and tested for operation before mixing the vaccine solution because live vaccines have a limited lifetime.
4. Ensure that cold chain has been maintained and check expiry dates and that the number of doses matches the number of birds to be vaccinated. The level of immunity depends on the activity of the vaccine and that the correct amount of vaccine will be taken in by the hens.
5. Ensure that the mixing water is free of chlorine or other disinfectants. The organisms in the vaccine will be killed by a disinfectant. (During house cleaning disinfectants are used to kill probably the very same organisms that were used in the preparation of the vaccine.)
6. When spraying make sure that the recommended spray nozzle is on so that droplet size will be correct. The size of the droplet determines how deep the spray will penetrate into the respiratory system of the hen and reach those organs that have to be protected against respiratory diseases.
7. It is most important that all birds receive the correct dose of the spray so that the immune development will be according to the required level. Birds should thus be sprayed twice to ensure the same level of immunity in all birds. (Birds with poor immunity will develop the disease when the virus makes contact with them and will serve as a source of contamination for other birds.)

Monitoring the health status of layers

Estimating the level of protection: Blood sampling

Immune status and blood sampling.

The immune status (level of antibodies) is not on the same level for all birds in a flock. It is thus important that the farmer will have blood samples analysed to establish the situation in his flock. Antibodies for diseases such as New-Castle disease and IB have a limited life span in hens, approximately 4 months, and depending on the disease challenge in an area it might be necessary to revaccinate with fairly short intervals. The veterinarian is the best person to advise.

The number of samples to take.

Important to ensure that a representative number is taken for the size of the flock. At least 30 individual hens must be sampled form a flock of a 1000 birds and blood must never be pooled, that means blood from one bird added to that of another. It is important for the veterinarian to see what the variation is between individual birds. It might be that the average titre count of a flock is within the limits of safety but that up to 30% or more can fall in the danger zone, in other words they would contract a disease, the virus multiplies in those birds and will infect birds in the safe zone.
Handling of samples. Blood is collected by stabbing the vein on the underside of the wing and vials filled to a height of at least 2 cm into the tube. Do not shake the tube as this causes rupturing of blood cells. Allow the blood to clot. If the samples can be taken to the laboratory for analysis on the same day, no further processing is necessary. If this is not possible the clot is loosened from the wall of the tube by means of a sterile paperclip (sterilize by dipping into alcohol) and the samples left for 12 – 18 hrs at room temperature. During this period the serum separates from the clot and can then be poured into a clean tube, or the clot removed and the samples stored at $4^{o}C$ in a refrigerator. During transportation to the laboratory the samples should be kept cool. If the serum had been frozen it must be kept in a frozen state.

Monitor the performance of the laying flock

Record keeping: The most important tool for success on a farm
A graph is a way of painting a picture from a set of figures and to make sensible and correct decisions. One has to see when production drops occur and be able to relate that to changes in environmental temperatures or a vaccine reaction, water shortage or perhaps to a particular load of feed that was delivered. Accurate records are the most valuable management tools on a layer farm. Hen-day production takes into consideration mortality and gives an indication on the level of production of the number of hens in the house.

Hen-day production figures are calculated by dividing the total number of eggs during a certain period, say 6 days, by the number of hens in the building during that period, multiplied by 6.
For example 880 hens X 6 = 5280 hen-days. The total number of eggs collected during that period amounted to 4541 eggs. The hen-day production is then 4541/5280 = 0.86 egg/hen-day. This figure is normally multiplied by 100 and thus expressed as percentage, ie 86%.

Daily mortality figures.
These are essential for calculation hen-day production figures but also to be able to evaluate health status.
The daily maximum and minimum temperatures. These provide information that can be used to explain variation in feed intake, production and even shell quality.

Feed consumption. Feed cost amounts to 70% of the production cost. Accurate records are essential to be able not only to determine feed wastage but also to identify factors such as house temperatures, vaccine reactions, a variation in nutrient density or even changes in raw material composition of diets that could have caused increases in feed intake.

Feed samples. These are essential to safeguard in case a particular batch of feed had caused a drop in production that could not be ascribed to factors such as high temperatures, water shortage in one or more lines, lights that had been out for some time, a vaccine reaction or any other abnormal condition that had existed. It is indeed best to keep at least a 10 kg sample of feed instead of the 500g that is normally delivered with a batch of feed.

Water consumption.
Daily records, and readings must always be taken at the same time every day, is a very sensitive and good indication of conditions in a laying house. Errors, such as a high salt content, at feed mills do occur occasionally and result in extremely wet droppings.
Increases in water intake can be an indication of a disease, provided that temperatures have been on the same levels as on previous days.

Stockman ship

This is the ability of a person to be able to notice or detect when something is wrong or has gone wrong in the laying house or on the farm.

It is skill that has to be acquired by looking at, listening to and sensing conditions inside a laying house and be able to notice whether things are according the norm or whether something will go wrong if not fixed immediately or has already gone wrong and is having negative effects on production.

How does one become a good stockman? It is definitely a never ending journey, you have to teach yourself and the willing person will always be learning and noticing new angles to bird behaviour and situations that when these are understood and correctly dealt with, always have a big impact on effective production practices and lot of job satisfaction for a person.

The following are some common problems to be aware of:

1. Spend time watching bird behaviour. Be familiar with the normal actions when feeding. Be on the lookout for abnormal actions such as only pecking at the feed and not swallowing the feed, feel their crops especially some time before the lights switch off when crops are filled for the night. Be on the lookout for birds regurgitating water onto the feed which could be due to high levels of salt in the feed.
2. Familiarise yourself with the appearance of the excreta and how house temperatures affect the consistency. Watery excreta could point towards scouring due to some form of diarrhoea for which professional advice must be sought.
3. It is important to recognize sounds that the birds make when content and how it changes with conditions such as water shortages. This is something that happens quite frequently when a water line was turned off to replace leaking nipples and it was forgotten to turn the water on again. In the beginning it might only be a slight increase in the normal tone of vocalizing but it will increase with time and should be recognized as unusual. If not corrected the excreta becomes dry, birds don’t eat and under serious dehydration they will start losing feathers. The observant stockman will notice the drop in egg production in a particular line long before birds stop eating!
4. Be on the lookout for shell discolouration. Diseases that affects shell colour are Newcastle disease and Infectious bronchitis.