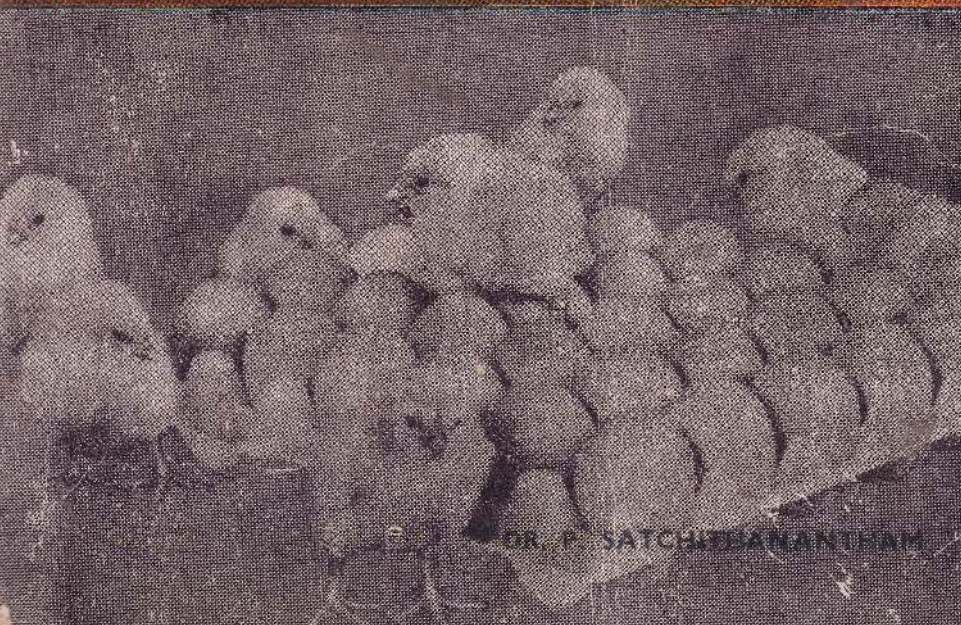
POULTRY

FARMING AND COMMON DISEASES



DR. P. SATCHITHANANTHAM

A HAND BOOK

ON

POULTRY FARMING

AND COMMON DISEASES

By

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A GUIDE FOR POULTRY FARMERS AND STUDENTS

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ABOUT THE AUTHOR.

Dr. P. Satchithanantham received his B. V. Sc. at the University of Ceylon in 1969. He also worked in the same University as a Research Assistant to Professor Peter Seneviratne and joined the Ministry of Agriculture as a Government Veterinary Surgeon. In 1976 he left abroad on a UNDP/UNV assignment to Lesotho and had opportunities to visit many South African farms of International standard. Then for a short time he worked in Kenya before leaving to Yemen Arab Republic to undertake a challenging job as the Veterinary Adviser to "Omeri Poultry Farms & Feed Mills" having a bird strength of about one million and a Hatchery. During this period he visited many other big poultry operations and met several Poultry Experts, Veterinarians and Nutritionists from Europe and USA in Conferences, Consultations and Business.

After returning home he worked at "Three Acre Farms Ltd./Colombo" for a short time until the July 1983 disturbances. At present he is attached to Animal Industry Consultancy & Services (Pte.) Ltd. as a Branch Manager and Consultant (Poultry). Recently he toured Canada to familiarise some of the latest technologies in Poultry Industry.

This book is written with all the above experiences and knowledge and with the idea of helping our Poultry Farmers to some extent as there are no similar book available for them. We hope readers will find this helpful to improve the standard of their farms and get more profits, if no negetive or theoritical approach is given.

Publishers.

DEDICATED TO MY PARENTS

CONTENTS:

INTRODUCTION

In agriculhirally advanced countries, poultry Farming is no longer an art or a way of life but a highly scientic and commercial business.

During the past 25 - 30 years drastic changes and development have taken place in the field of Poultry Farming. Today poultry is a product of complex breeding and selection which is worthy for the best of housing, feeding & management that can be given.

A controlled, systematic and efficient programme & management for an improved breed is the key to successful poultry production. The most important management rule is to satisfy the basic needs of the bird. Here one must try to obtain the maximum performance from the birds by identifying and providing the best possible economical facilities available in housing, feeding, marketing etc.

The evolution of the poultry industry could be easily recognised when we analyse some of the recent production perfomances of the present "HYBRID" birds. A laying bird that originally started some years ago by giving about 150 eggs or less per year, has now developed little by little to produce about 300 eggs per year. Those days a broiler which was reared for about 10 - 12 weeks or more to give a fair weight has now been converted slowly to a meaty bird grown for only about 6 wks to give about 1 . 5 kg liveweight with a feed conversion of less than 2 . The following facts also clearly demonstrate the developoment of the industry

	30 yrs. ago	Now
(1) Feed used to produce a dozen of eggs -	2.7-3.2 kg (6-7 lbs)	1.6-1.8 kg (3.2-4.0 lbs)
(2) Weeks to produce a 1.8 kg broiler -	15 (4.0 lbs)	7
(3) Feed used to produce a 1.8 kg broiler -	7.3 kg (16 lbs)	3.6-4.1 kg (8-9 lbs)

The chief poultry producing countries in the world are U. S. A, Europe, Canada, Australia Japan, China, U. S S. R. India, Middle East, Philiipines etc. Of these the most advanced and scientific methods are applied in America and Europe.

CHAPTER I

POULTRY BREEDS BREEDING AND HYBRIDS:

(I) BREEDS

Poultry production & breeds of poultry can be broadly divided into two depending on the type & need such as:-

(1) Egg production / Layer breeds.
(2) Meat production / Broiler breeds.

For egg production a bird should have typical characteristics such as lean body conformation, less eating with high producing ability. The common layer breeds are the White Leghorns (white), Rhode Island Red (RIR) (brown), Australorp (black), New Hampshire, Light Sussex, Plymouth Rock, etc. However nowadays news special Hybrids, bred exclusively to produce more eggs economically are available by crossing several of the above lines. These Hybrids have specific (trade) names to represent their farms or institutions from where they were bred and produced; such as Hyline (U. S. A.), Hissex (Holland), Babcock (U. S. A.), Tetras (U. S. A.) etc.

On the other hand the characters needed for a broiler bird should be based on rapid growth and weight gain in short periods with efficient feed conversion; Those days heavy birds were used as table birds. But now Hybrids (synthetic lines) of Broilers have come as a result of scientific breeding and selection; representing their origin such as Cobb (U. S. A), Ross (U.K.), Hybro (Holland), H&N meat nick (Scotland), Hubbard (U. K.), Shaver Starbro (Canada) etc.

(1) POULTRY BREEDING

The fowl has only one set of ovary in the left side of the body with the oviduct opening into the cloaca. There are 39 pairs of chromosomes in a fowl including a pair of sex chromosomes. In poultry it is the female that carries the Y chromosome and thus decides the sex of the offspring.

While breeding the following characters should be kept in mind inorder to obtain a quality bird.

(a) Egg production (Layers)

1. Number of eggs.
2. Age of sexual maturity.
3. Intensity of laying.
4. Size of egg.
5. Frequency and persistency in Broodiness.
6. Feed conversion efficiency.
7. Shell quality.
8. Yolk colour.
9. Livability of the bird.
10. Hatchability of its egg (for parents & grand parents).

(b) Meat production (Broilers)

1. Growth and weight gain.
2. Feed conversion efficiency.
3. Meat / Bone ratio.
4. Breast width.
5. Succluent flesh.
6. Quick feathering.
7. Livability.
8. Egg production for parents & grand parents.
9. Hatchability of parent eggs.
10. Colour of birds, skin and flesh.

(3) MODERN BREEDS OF CHICKEN

During the past two centuries many pure breeds and varieties of chicken have developed all over the world, However few have survived commercialism in the poultry industry and being used by the poultry breeders today. Most of the early breeds are now lost for ever but some are maintained still by Breeding stations for the purpose of getting new lines. The gene pools are an important part of the breeding programme to maintain certain genetics found in the rare breeds.

CHAPTER 11

POULTRY FARMS, HOUSES, SYSTEMS & THEIR REQUIREMENTS:

(1) POULTRY FARMS:

Unlike Agricultural crop farms a Poultry farm comparatively needs very little space and labour. Most of the poultry farms in Europe, America and other developed countries are now working on controlled environment houses with automatic and mechanised equipments for heating, cooling, humidifying, feeding, watering, egg collection etc. Now the latest popular poultry houses are built as 'Turnkey projects'.

However in developing countries everthing mentioned above need not be mechanised or automated because of the small sizes of the farms, instalment costs, and poor marketing. If exports of poultry products commences it is worthy to think for a typical fully controlled and automatic farm. This will work like other automated industries where one has only to bring raw materials to prepare feed and the chain of activities for production will just follow in a cycle.

(2) POULTRY HOUSING:

Undoubtedly a good housing is essential for poultry in order to give comfort and production to the birds as well as convenience and income to the farmer.

ESSENTIALS OF GOOD HOUSING:

(a) COMFORT:

The best production is secured from birds that are comfortable and happy. To be comfortable a house must provide

adequate accommodation, be reasonably cool in summer, free from drafts and sufficiently warm during colder seasons, should provide optimum supply of fresh air and sunshine while re maining dry inside,

(b) PROTECTION;

They include safeguards from theft and other natural attacks from animals, birds, snakes, external parasites etc·

(c) CONVENIENCE;

The housing gives a collection of labour at one spot and supervision at one glance. Further the houses should be located at a convenient place and equipments arranged similarly for cleaning, repairing and filling, water, feed, fuel etc.

(d) HIGHER PRODUCTION;

Given the above sufficiently the poultry responds excellently in production and health.

(3) LOCATION OF POULTRY HOUSES:

In planning a poultry house or a farm complex some important factors should be considered;

(1) The poultry houses in a farm should not be built closer to the other farms as to create unsanitary conditions. The farm should be fenced all around and sited little away from public transport and gatherings. The farm houses could be located at the entrance of the farm and watcher's units built all around for visits and transits.

(2) The poultry houses can preferably face south or east in moist localities for more sunlight to get in. Birds prefer morning sunlight to that of afternoon.

(3) The ground should have good drainage and the soil should be fertile to have good vegetation for shade and cooling Trees should serve as a wind break in the winter and shade giving in summer. They should be tall with no low limbs.

(4) There should be good water and electricity supply with smooth and close access to main roads.

(4) SYSTEMS OF POULTRY HOUSING:

There are about 4 systems of housing generally followed by poultry farmers. The type of system adapted depends on the demand, extent and the capital available, along with marketting facilities.

(a) FREE RANGE SYSTEM:

This is the oldest method of all and used for centuries where there was no shortage of land. The birds rest on trees in the night. At present due to advantage of intensive methods and commercialism this system is almost obsolete except in villages on small scale.

(b) SEMI INTENSIVE SYSTEM:

Here the birds are left out in the run like in free range system but some housing is also provided for them to be kept inside during nights and when conditions are unfavourable outside.

(c) BATTERY SYSTEM:

This is the most advanced intensive type of poultry prodution system, and is useful to those who have very little space but with enough capital to construct cages.

Here each bird or a group of birds are confined to a cage just large enough to permit limited movements but allowing her to stand and sit comfortably. Usually a floor space of about 14" x 16" and height 17" is allocated for a bird.

The floor will be of standard stout galvanized wire netting, sloping from back to front so that the eggs laid can roll out of the cage to a receiving gutter in front thus able to identify laying qualities. Underneath is a tray for the droppings which is removable for periodic cleaning and replacements. Both feed and water are given from outside the cage which is economical and rationable.

Many small cages can be assembled together and if necessary may be multistoried, providing the batteries of cages with enough ventilation, light and optimum temperature. Here the efficiency of the bird will be high and culling is easy making minimum wastages. This is good for commercial layers

(d) DEEP LITTER SYSTEM:

This is one of the common intensive systems and is the most popular and cheaper of the two. Here the birds are confined to the house entirely with no access to the land outside. In this system the birds are kept in large pens in hundreds and thousands on floor covered with litters like paddy husk, straw or wood shavings. Deep litter is some thing with the materials used for litter and the accumilation of poultry manure until it reaches a depth of 8-12 inches. This build up has to be carried out correctly to give desired results which needs little attention. Deep litter resembles dry compost.

The basic rules needed here are as follows:-

(1) Do not have too many birds in the pen other than the specific stocking density.

(2) Provide sufficient ventilation to enable the litter to be kept in correct condition for dryness, smell, and infections.

(3) If litter gets caked by water from the waterers or leaks through roofs etc' remove only this portion out and put in new litter and the birds will mix well on their own.

(4) Build litter little by little according to the need and time; while removing too do it gradually.

(5) Do not change litter entirely except after complete treatment for coccidia or worn imfestations, changing all of a sudden, altogether alters the environment of the bird and stress with poor performance may result.

ADVANTAGES IN DEEP LITTER SYSTEM:

(1) Safety of the birds are more sure than being out and exposed.

(2) It is land saving and economical in operation and maintenance.

(3) There is a better disease control if the litter is well managed. The birds being in litter becomes well exposed to many different bacteria and other disease producing agents. A type of natural tolerance or immunity develops in them against these specific agents. Also to an extent the phenomenon of interference could be possible for new incoming diseases agents.

(4) Labour saving is obvious as the equipments to this system are meant for collection of birds or groups.

(5) There is a believe that deep litter supplies some unidentified animal protein factors along with some essential Vitamin B (Riboflavin) to the birds.

(6) At the end of the rearing the deep litter becomes a valuable mannure to the garden.

(7) Litter also acts as a weather safe guard to the birds. In hot weather the bird can dig in to the litter with feathers opened to loose excess heat. In cold weather the bacterial action in humid litter evolves heat.

The housing for a small scale deep litter can be as simple and less expensive as possible but with an idea to give maximum necessary comfort to the birds. The building should have hard floor preferably concreted and with dwarf walls of about 1-1½ ft high running all around and wire netting above supported by wooden frames so that no unwanted creatures can creep inside. The roof is preferred to be in tiles. The other materials like asbestoes or tin sheets may need insulation.

The equipment needed will be the feeders, drinkers, egg laying boxes, roosts (or perches) according to the number of the birds.

CHAPTER III

SANITATION, CLEANING, DISINFECTION & ISOLATION (OF THE FARM)

(A) SANITATION:

Commonly disease problem in poultry farms can originate from 3 sources:-

(1) New poultry brought to the farm.
(2) Contaminated premises or spread from neighbourhood.
(3) Lack of sanitation.

(B) CLEANING & DISINFECTION:

(1) Depopulate the entire flock if possible, and remove old litter to far away place.
(2) Discard old feed.
(3) Remove, clean and disinfect equipments outside the house.
(4) Clean, wash & disinfect the house.
(5) Fumigate house with equipments and new litter in.
(6) Apply insecticide to the floor, wall and outside the buildings, if necessary.
(7) Close; lock and rest the house until new flock arrives.

(C) ISOLATION:

Poultry should be segregated according to age; species; breeds and class. For best isolation the following is important:-

(1) Locate the farm away from public road and gatherings.

(2) Fence around the farm.

(3) Have seperate caretaker for each house, or atleast each age group.

(4) Build houses far away from each other as much as possible.

(5) Remove used litter out from the farm.

(6) Control visitors, and stray birds to the farm.

DISINFECTANTS:

There is a wide variety of disinfectants available for poultry sanitation. For effective disinfection thorough cleaning is the first and vital step. Scrubbing or washing with high preasure washers is very essential before applying disinfectants, so that all organic matter covering the surfaces are removed for the action of the disinfectant.

The various disinfectants that could be used in poultry houses are as follows;-

(1) ALKALIES:

Alkalies of sodium, pottasium, calcium and ammoninm are the stronger forms. The weaker ones include carbonates, bicarbonates, silicates and alkaline phosphates. These compounds are more used for their cleaning action than for their germicidal action. The disadvantages in using these are that they need higher concentrations and it is dangerous to the workers; in addition to poor germicidal property.

(2) QUATERNARY AMMONIUM COMPOUNDS (QAC)

As an improvement to the above mentioned alkalies the QAC came in but these too could not satisfy fully the needs for disinfection.

DILUTION RATE:

For sanitising 200 ppm.

For disinfection 400 - 800 ppm.

(3) HYPOCHLORITES:

These are the halogen sanitiser disinfectants. These compounds act by releasing the halogen. Household bleaching powder contains about 5% available chlorine derived from sodium hypochlorite. These are very effective germicides but should be used on precleaned surfaces in diluted solutions. They also work as effective sanitisers.

(4) CRESOLS AND CRESILIC ACIDS:

These are coal - tar derivatives with strong characteristic odour and concentrated solutions irritate the skin. These compounds turn milky when added to water. The odour limits their acceptance for the use in chick houses. Concentration for use varies with the type of compound.

(5) PHENOLIC COMPOUNDS:

These are also coal - tar derivatives. There are synthetic phenols which are more germicidal and less toxic to tissues than the natural. Phenols have a characteristic odour and turn milky when added to water. Organic materials have a diluting effect but do not inactivate them.

DILUTION RATE:

Sanitising 50 ppm.
Disinfection 100 ppm.

Common uses are for egg dipping, disinfection of hatcheries, poultry houses, equipments and for foot bath solutions.

(6) BLENDED GERMICIDES:

These are combinations of two or more germicides such as phenol, formaldehyde, alcohol and quartenary ammonium compounds. Thus have a broader spectrum of activity than the single compounds. Blending of these germicides are formulations of compounds that are compatible and additive in action. For the use follow manufacturer's directions.

CHAPTER IV

MANAGEMENT OF BIRDS (POULTRY)

(A) CHICK MANAGEMENT (BROODING):

Egg production really begins on the very first day, a chick is hatched. Bringing up of chicks (brooding) is the most important stage in poultry operation as care taken during this perlod governs the future productivity and livability of the birds. Any set back early in the chick's life such as chilling, overheating, overcrowding, improper ventilation, diseases, malnutrition etc, will permanantly affect the laying capacity.

(I) HOUSING THE CHICKS (BROODER)

The chick should be reared far away from other grown up birds as disease can spread from the bigger birds (which may be immune to certain diseases or can resist, acting as carriers). A thorough cleaning and disinfection programme should be followed before the arrival of the chicks in the brooder. As much as possible draw a suitable programme for your farm depending on the possible diseases and contamination in your area. Consulting a Veterinarian / Poultry Specialist is always advisable. A tentative chick programme is given behind as a guide.

The brooders (heating campartments) can be designed in several forms. But the main objective should be directed on an efficient, economical, healthy (to the chicks) and comfortable structure or arrangement that can provide heat, air, humidity, feed, water etc. to the innocent young ones.

TYPE OF BROODERS

(a) Sometimes back brooders were made like boxes, surrounded by wire netting but covered outside by gunny bags or

papers. Here the floor is also of wire mesh and preferably the area between the ground and the bottom of the boxes is also covered well to stop drafts drawn from below. In this type about 50-100 chicks per box can be reared comfortably.

(b) The other type that is also commonly used is the cannopy and chick guard cambination. Here too, birds in large numbers cannot be reared together without partitioning.

(c) Large scale brooding is done in closed rooms, halls or houses where the heating is done either by space heaters or by hot air blowers or cannopy and bulb / gas heaters arranged one after the other using chicks guards in one or many circles, depending on the efficiency of each heating arrangements. As the chicks grow and get matured; little by little the surrounds (guards) could be widened or united to one another giving more room for easy access to heat, feed and water. This system is mostly used in large scale brooding and in commercial broiler production.

(2) BROODING MANAGEMENT:

(a) FLOOR SPACE REQUIREMENT FOR CHICKS:

Have 15 - 20 birds per sq. meter. A chick should be grown in the brooder for at least 4 wks and sometimes little more in very cold climate. Thereaffer they could be shifted or opened without guards in the house meant for them to grow. Shifting too often and handling always at different ages or for various reasons are not advisable as these may stress the birds.

(b) BROODING TEMPERATURE:

The optimum temperature for a brooder on the first two days of the life should be about 35 - 32° C (95-90° F) depending on the out side temperature. In cold climates it is better to be on the higher range as risks may be there. Thereafter the temperature could be lowered gradually day by day falling down by 2 - 3° C(5° F) each week up to 25 - 24° C at about

the 4th week. Fluctuations of temperature of more than 6° C or 11° F within day is detrimental.

The best rule for successful brooding is, by the observation of the chick distribution in the brooder. Too much of crowding near the heat source means too cold for the chicks and if the chicks stay far away from heat source it means too hot. So the best is to get the chicks evenly distributed all over the space actively eating, drinking, running and playing about.

In the brooder the chicks should have enough space and easy access to water and feed. The approximate intake of water and feed are given in the table, at the end of this chapter.

(c) LIGHT REQUIREMENT : (For brooders)

For the 1st 48hrs use about 3.5 watts for each 4sq. ft (or O.37sq.m) at about 8ft high from floor. Thereafter it can be about 1 watt for each 4 sq . ft.

(d) FEEDING:

Broken maize or rice is good to prevent pasty back for the first day and thereafter start with chick mash containing about 18 ·/. protein. The following may be the feeder space requirement:-

Trough = 2in. (5cm) / chick.
Round pans = 1.6 in (4cm) / chick.

(e) WATER:

Should be supplied fresh everyday and glucose or sugar, vitamins, minerals, antibiotics etc. could be mixed in, when necessary. If troughs or pans are used O.6 in (1.5cm)/ chick area should be given.

The feeders and waterers should be distributed preferably in an alternating fashion (feeder - waterer - feeder - waterer.) and no bird shall have to go over 10ft (3m) to get water or feed.

(f) DEBEAKING:

The best age may be at 6 - 9 days. If this is not done at this age, can do at 10 - 12 wks of age. Nowadays debeaking is done well by debeaking machines where a hot blade drops and cuts while cauterizing the cut edge of the beak.

While debeaking correct technique should be adopted so that accuracy and shape are preserved. If too much is removed the bird may have to be culled and if too little removed the purpose of debeaking is lost. Before and after debeaking antistress drugs such as multivitamins & minerals or aminoacid preparations could be given in water and antibiotics are also used if there are chances for any infections.

(B) GROWERS MANAGEMENT:

(a) LITTER:

During growing period the litter should contain about 20 % moisture for:-

(1) Better feathering.
(2) Normal growth.
(3) Improved feed conversion.
(4) The control of coccidiosis.

If wetting the litter is necessary, do it little by little every day by spraying. Never add the entire water at one time to enhance coccidiosis. Avoid wet spots around drinkers by removing out the caked litter and putting new litter only at that spot.

(b) ROOSTS:

Roosts are normally not needed for growing birds. Avoid high objects and use antiroosts. In very hot climates roosts or perches are used as the birds can cool themselves by getting better ventilalion from below.

(c) FEEDING:

Growers mash containing not less than 15 ·/. protein and enough calories (2800 k. cal / kg) should be used. Ample feeders

should be well spread uniformly all over the house. This will avoid competition and thereby produce uniformly grown birds. Balanced nutrients to get maximum percentage of lay is also important. If few feeders are used; bigger and dominating birds will get chance to eat first and the smaller birds will get only the left overs making them worse. On the other hand bigger birds will deposit fat very soon and stop lay.

(d) FEEDING GRIT:

This is still a debatable issue but if larger particles are fed in the mash, grit is needed. Also when they are eating feather, litter etc, grit is wanted. On deep litter, feed at a rate of about 1 lb per 100 birds per week, but all the weekly quota put at one day and donot self feed.

(e) LIGHTING FROGRAMME: (For open houses)

For growers decrease light. To controll light find out the number of hours of natural light when pullets reach 20 weeks Then add 7 hrs to this figure. This total represents the length of the light from 3rd day of age. There after reduce 20 minintes each week. This approximates 7 hrs in 20 wks. Then at 20 wks increase the length of light by 1 hr / wk till 16 hrs of light while laying.

For eg:
In Srilanka the length of day light is usually 12 hrs (morning 6 to eveving 6) add 7 hrs to this 12 hrs of light = 19 hrs. So at 3 rd day give 19 hrs of light. There after reduce 20 minutes every week, until 20 wks of age etc - etc.

(C) **LAYERS MANAGEMENT:**

(a) HOUSING OF LAYERS:

The growers should be moved to the permanant laying quarters atleast between 14 - 21 wks. But the layers ration can start after 21 wks.

For a bird to perform well in laying the following factors are very important;-

(1) Proper environment (Temp, Humidity, and Ventilation).

(2) Reproductive Performance and Breed quality.

(3) Comfortable and adequate equipments preferably automatic.

(4) Balanced nutrition.

(5) Health and Livablity.

(6) Endocrine activity due to light stimulation, etc.

The space requirement for layers will be about:-

(1) Light breeds (Leghorns) = 1.75 sq. ft / bird or 6.2 birds / sq. m.

(2) Medium sized breeds (Brown varieties) = 2 sq. ft/bird or 5.4 birds/sq. m.

(b) EQUIPMENTS;

	Leghorn	Medium sized
(1) FEEDERS:-		
Troughs (one side)	2.5" (6.4 cm)	3" (7.6 cm)
Round pans (16" diameter)	2"	2.5"
(2) WATERERS:-		
Troughs	0.75" (1.9 cm)	0.85" (2.2 cm)

(3) PERCHES AND ROOSTS:-

Chicken start roosting when they are 8 wks old. This may help the bird to cool in hot climates and keep their feet and plumage clean. One can make perches from long wooden bars of 2 sq. in, rounded at the top and flat at bottom. Fix these bars at about 16 - 24 inches above the ground near the walls in such a way that they could be removed for disinfection. Give atleast a 12 inch space between two perches with about 8 inch per bird.

The rear perch should rest little higher than those at the front. There are differences in opinion for the provision of roosts in poultry. It is better to decide on the spot specifically, depending on the need in the farm. The behaviour of the birds and the condition of the houses along with climate can decide in providing perches.

(4) NESTS

Should have single compartment and provide one nest hole for every 4 - 6 birds. Place them cross wise in the house and can be in tiers (maximum 3) with the lowest floor at about 2 ft above the litter. These should be provided and opened at about 1 wk before the first egg is laid. It is better to close the nests in the night and do not allow the hens to rest in the nests during night. Roof of the nest should be sloping to avoid roosting and dirtying.

SIZE:

1 ft wide, 1 ft long, 1 - 1½ ft deep, Front lip ; 3" - 4" to retain.

(5) SHELL HOPPERS:

Provide one hanging feeder for every 200 hens with oyster shell or others like calcium carbonate.

(6) GRIT HOPPERS:

Also one feeder for 250 hens at the rate of 1 lb of grit per 100 birds per week; fed once a week; the entire requirements at one time.

(c) HOUSE TEMPERATURE AND LAYING PERFORMANCE

Cool but not cold environment is the best for laying. Egg production is not affected until temperatures up to 27° C (80° F) but the egg size decreases over 24° C (75° F). The feed efficiency decreases over 16° C (60. 8° F). The best efficiency (around 100%) is seen at about 15. 6° C (60° F), for all round performance such as number of eggs, size and feed conversion.

The above temperatures may not be possible in most parts of our country but an efficient poultry-man should take all possible economical steps to cool the house by the following means as much as possible to get maximum laying:-

1. Insulate roof.
2. Ventilate.
3. Provide fans for faster air movement.
4. Lower the humidity.
5. Use foggers.
6. Sprinkle roof.
7. Wet the area outside and around the house.
8. Plant shades around and water the trees.
9. Provide cool nest (open back for ventilation).
10. Increase water space and supply cool fresh water.

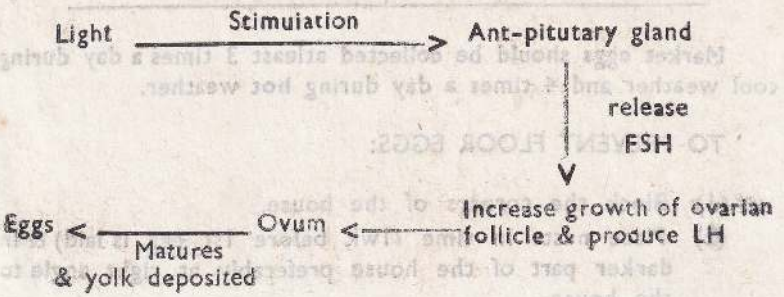
As a guide for advanced poultry keeping, here is the ventilation requirement equation:

$$Q = \frac{H}{1.08\ (T_i - T_0)}$$

Q – Air flow rate (CFM/bird)
H – Birds' heat produced. (BTU/hr/bird)
T_i – Indoor Temp – ^{o}F
T_0 – Outdoor Temp – ^{o}F

(d) LIGHT IN LAYING PERFORMANGE:

Hours of light (natural or artificial) must be increased when the bird reach sexual maturity. This programme can only give 100% results in closed houses but in open houses this could be tried with difficulty.



The quantity of light necessary for the bird to eat and drink is usually low. After some training they need less than $\frac{1}{4}$ foot candle; However to stimulate pitutary about 2 - 4 times the above is necessary which is a must for egg production.

EFFECTS OF LIGHT ON GROWTH OF CHCHKEN

(1) The lighting programme together with feed restriction programme can delay sexual maturity by about 4 wks.

(2) Light duration have effects on the size of the egg laid during the 4 - 5 months of production.

(3) Light have its effect on the number of eggs laid during the 1st half of the laying period.

(e) LIGHTING PROGRAMME: (Refer 16 & 37)

Birds start laying after 1 - 2 hrs when the light becomes bright. So close the nests in tne night after removing birds from it if they are still in, and open them early in the morning.

Hours after bright light begins	% of daily lay
1 hr	few
2–3	40%
4–5	30%
6–7	20%
8–9	10%
10–11	few

Market eggs should be collected atleast 3 times a day during cool weather and 4 times a day during hot weather.

TO PREVENT FLOOR EGGS:

(1) Block the corners of the house.
(2) Place nests in time (1wk before 1st egg is laid) & in darker part of the house preferably at right angle to the house.

(3) Darken the nest with cover, but care should be taken for hot weather conditions.

(4) Have adequate number of nests (4 - 6 birde per nest).

(5) Keep nesting materials clean and ample.

(f) BROODINESS:

Brown egglayers are more common. Have small cages with wire or slat floor constructed in the poultry house and put the broody hens inside. The broody instinct will disappear in 2 - 3 days and afterwards return them to the floor. Provide feed and water in this broody coop.

(g) FEEDING LAYERS:

Good reliable balanced mash containing atleast 16 - 17% protein and 2700 - 2800 k. cal/kg M. E. and other nutrients is a must for the birds. About - 100 . 125 gms of feed/bird/day is the average requirement. Over feeding can lead to fat deposition and poor lay. A days ration could be supplied early in the morning equally distributed in adepuate number of feeders, to avoid competition and selection while eating. Some farmers give greens or grains in the evening according to the size of the farm, convenience and ecconomics. At about 21 wks of age change, diet from growers to layers while increasing the duration of light. If increase in feed intake is noted (early emplying of feeders) when laying starts, it is better if the feed is increased at the rate of 1lb/100 birds/day until they are on full, feed. Donot over feed as it is uneconomical and may bring poor production. Supply additionai calcium (at about 7 days) prior to the onset of laying. In this matter a slight delay is always better than starting too early. Always consult the breeders for the bird s body weight and feed consumption rate and try to restrict the ration, along with checking body weights weekly.

(h) PIGMENTATION:

Pigmentation gives some information regarding a bird's past production, in the case of hens having yellow skin and shanks. During the period of production the body gradually loses its eserve of yellow pigment. The order of disappearance of pigment

from the body and the approximate period of egg production required to bleach the body structures are as follows:-

Parts Bleached	Time	Approximete number of eggs laid
Vent	1- 2 wks	5- 10
Eye rings & Ear lobes	2- 4 wks	10- 15
Beak	6- 8 wks	15- 40
Shanks	12-20 wks	70-190

When the bird stops production the pigments return in the same order and approximately twice as fast as it left.

(i) MOULTING:

Moulting is the process of shedding and renewing of feathers. This normally occurs once a year and more rarely once in a period of two years. Hens usually moult in the following order:-

(1) Head (2) Neck (3) Body - wing and tail. In the wing there is also some regularity about the moult. The wing primaries begin to drop before the secondaries. The first primary to be shed is the inside one, next the axial feather, and the remainder are shed in succession until last the one to be dropped is the outer most primary near the tip of the wing. The bird that moults early is a poor layer and vice a versa.

(j) FORCED MOULTING:

The economics of forced moulting and also the best method for forced moulting is still a question. The producer must evaluate such a practice depending on market outlook, stage of production of his flock and the cost of replacement pullets versus loss of income during moult, disruption of a set replacement programme etc. Forced moulting is also considered to be as something cruel and sinful to the birds.

Once the decision has been made to force moult, one should draw a programme to put the birds out of production completely and then back in production as quickly as possible.

The most effective method of forced moulting is to remove feed and water from the hens. The length of water restriction is usually 2 - 3 days depending on the climatic conditions. Feed restriction up to 10 days will result in complete moult as well as removing excess fat from the hens. It is necessary to drop the curtains completely to cut light during this period. Some times 10 days without feed, especially for hens on restricted feeding programme may not be essential and adjustments should be made accordingly. A 16% protein in growing diet could be fed to the hens from day 10 until 5% production at which time they could be fed with normal layers diet. Care and common sense must be used during this process because the birds being without water for more than 3 days will have severe stress. Multivitamins and minerals could be given as antistress aids in drinking water for few days.

TABLE TO SHOW THE EFFECT OF REMOVING FEED AND WATER (FORCED MOULTING)

Days from initial moult	1	2	3	4	5	5–20	50
Approx Percent Production	64	58	31	7.5	0.5	0.0	50%

Time without feed – 10 days
Time without water – 3 days

(k) HANDLING MARKET EGGS:

(1) Oil the eggs if washing has to be done after several hrs.
(2) Cool the eggs to preserve.
(3) Donot pile up too many eggs without cousioning materials.

MINIMUM FLOOR, FEEDER AND WATERER SPACE REQUIREMENTS (APPROXMATE) PER 100 BIRDS

No.	Type of Bird	Floor Space		Feeder Length		Waterer Length	
		(m^2)	(ft^2)	(m)	(feet)	(m)	(feet)
1.	Chick (0–4 wks)	4.65	50.0	2.45	8.0	1.20	4.0
2.	Growing birds (5–10 wks)	9.30	100.0	6. 1	20.0	2.05	6.7
3.	Growers (11–20 wks)	21. 0	225.0	7,65	25.0	2.45	8.0
4.	Layers (white)	13.95	150.0	7.65	25.0	2.45	8.0
5.	Layers (brown)	18. 6	200.0	7.65	25.0	2.45	8.0
6.	Broilers	7.45	80.0	4. 6	15.0	1.85	6.0
7.	Breeders (Broiler)	27. 9	300.0	10. 7	35.0	2.45	8.0

APPROXIMATE WATER REQUIREMENTS CHICKEN PULLETS

Per 100 birds / day

Age (weeks)	U. S. Gallons	British Gallons	Liters
1	0.5	0.42	1.9
2	1.0	0.84	3.8
3	1.5	1.26	5.7
4	1.9	1. 6	7.2
5	2.3	1.93	8.7
6	2.7	2.27	10.3
7	3.1	2. 6	11.8
8	3.4	2.86	12.9
9	3.7	3.11	14.1
10	4.0	3.36	15.2
11	4.3	3.61	16.0
12	4.6	3.86	17.4
13	4.8	4.03	18.1
14	5.0	4. 2	18.9
15 on wards	5.5	4.62	20.8
Laying hens (21 °C=70 °F)	7.0	5.88	26·5
(32 °C=90 °F)	9.5	7.98	35.9

Note:

These figures will vary according to weather, temperatnre of the house, breed diet, etc.

AGE, BODY WEIGHT AND FEED CONSUMPTION GUIDE-LINES PER BIRD
(APPROXIMATE)

Age (weeks)	Body weight (gms/bird)		Daily feed Consumption		Cumulative Feed Consumption	
	White Layers	Brown Layers	White (gms)	Brown (gms)	White (gms)	Brown (gms)
1	91	113	13	16	90	113
2	145	191	16	25	218	295
3	205	282	25	36	391	491
4	273	372	32	40	614	768
5	341	468	36	41	868	1059
6	409	564	38	43	1136	1364
7	486	673	39	45	1409	1682
8	577	795	41	48	1695	2018
9	659	882	41	50	1982	2368
10	741	968	45	52	2300	2732
11	814	1050	50	55	2650	3114
12	886	1132	50	57	3000	3514
13	955	1209	55	59	3382	3927
14	1023	1286	55	61	3764	4355
15	1082	1359	59	64	4177	4800
16	1136	1432	59	66	4591	5269
17	1182	1500	64	68	5036	5741
18	1227	1564	64	71	5482	6232
19	1264	1627	68	73	5959	6741
20	1295	1686	68	75	6436	7268
21	1323	1741	73	77	6946	7809
22	1345	1795	73	80	7455	8364

Note:

After 22 wks increase gradually so that a maximum ration of about 118 grams for white layers and about 130 grams for brown layers comes at about 6 to 7 weeks after production commences and thereafter may gradually decreased to a minimum level of 105 and 120 grams after 20 wks of production for white and brown birds respectively until end of lay. All increases and decreases should be made uniformly. The figures will vary for different breeds, feeds, climatic conditions and management practices,

PRODUCTION PERFORMANCE

OF A GOOD COMMERCIAL WHITE LAYER

(AS A GUIDE FOR FARMERS)

Age of Birds (Months)	Approx. Production Performance (Hen-Day) (Percentage)	Body Wt. (Kg.)
5	04%	1.32
5½	15	1.40
6	45	1.47
6½	75	1.53
7	90	1.59
7½	92	1.60
8	92	1.61
8½	90	1.62
9	88	1.63
10	85	1'66
11	82	1.69
12	78	1.70
13	75	1.71
14	71	1.72
15	69	1.72
16	67	1.72
17	64	1.72
18	63	1.72
19	61	1.72
20	58	1.72
21	55	1.72
22	53	1.72
23	51	1.72
24	50	1.72

A CHICK REARING PROGRAMME
(Tentative for Layers only).

DAY 1 : Put Chicks in Brooder (Temp. 32 - 35° C) and give in drinking water Glucose or Sugar (8% sugar ie. 3 lbs/5 gal.) and Multivitamins.

DAY 2 : Give Multivitamins + Tetracyclines. and continue this for another 2 - 3 days (consecutive).

WEEK 3 : Sulphaquinoxalene for 2 - 3 days to prevent Coccidiosis. Follow this with Multivitamins for 2 - 3 days.

WEEK 4 : Vaccination for NCD (Ranikhet) - first vaccination. ($\frac{1}{2}$ dose).

WEEK 5 : Worming with Piperazine campounds. (Pip. Cit.....2 tablespoons in $\frac{1}{4}$ gal. of water)

WEEK 6 : Fowl Pox vaccination (First)

WEEK 7 : Sulphaquinoxalene for 2 - 3 days.

WEEK 9 : Repeat worming if necessary. (4 tablespoons in one gal of water).

WEEK 10 : Debeaking. follow with Multivitamins as antistress for 3 - 4 days.

WEEK 12 : NCD/ Ranikhet Vaccination (Booster - Full Dose).

WEEK 14 : Worming if necessary.

WEEK 16 : Fowl Pox Vaccination (Booster).

WEEK 18 : Coccidiostat if necessary.

WEEK 19 : Worming.

CHAPTER V

BROILER MANAGEMENT

The sanitary precautions, cleaning and disinfection for broilers is more or less similar as like that mentioned for layer chicks. "All in all out" policy is ideal in broiler production. The common diseases and problems that are specific for broilers should be given special emphasis. A suitable programme should be drawn to meet these requirements. The housing of baby chicks and the temperature of the brooders need no wide variation from layer chicks. But the age at which your broiler is to be harvested is important for any changes.

(1) SPACE REQUIREMENTS:

(a) Stocking density (area requirements) = 15 - 20 birds/m^2

(b) Feeder space = 1 round feeder diameter 40 cm(16 in) is for 70 birds.

(c) Waterer space = 1 round waterer 33 cm (13 in) is for 140 - 200 birds.

(2) FEEDING:

The life of a broiler bird can be divided in to 2 - 3 stages for different feeding programmes;-

(1) Starter (1 - 4 wks)

(2) Grower (4 - 6 wks)

(3) Finisher (after 6 wks)

(Some times the grower stage is ignored and the other two stages are given importance.)

Generally the recommended starter ration contain more crude protein up to 22 - 24% with special emphasis to methionine, methionine/cystine and lysine percentages which are comparatively little more than that for grower and finisher rations. The metabolizable energy varies between 2900 - 3200 k. cal/kg where as in grower and finisher rations the crude protein percentage varies between 21-23% and 19-22% respectively. The metabolizable energy is at higher range for finishers for fattening. The nutrients, requirements, feed formulations, the amount of feed intake, the weights expected and the feed conversion ratios are given in tables at the end of this chapter.

(3) HEATING (Temperature of house):

Unlike layer birds, the broiler is grown for only 6 - 8 wks in advanced countries. Here everything is directed to the quicker growth of the bird and as such poor feed, losses from unnecessary activities, diseases, stress, body heat wastage to compensate the environment etc must be avoided. The temperature of the house for broilers must be slowly lowered little by little starting from 35 - 34° C (93° F) for 1st two days of life and to 33 - 32° C till the end of 1st week.

Thereafter gradually lower the temperature by about 2° C per week ending at about 22 - 24° C at 6 wks. After 6 wks can run the temperature at about 18 - 21° C (64 - 70° F). The above ranges vary greatly for different climatic conditions and small adjustments should be worked out if necessary. At these temperatures the birds can easily perform at about 100% feed efficiency provided everything else is optimum.

(4) LIGHTING:

The amount of light that could be supplied can be about 1 watt/m^2 floor space and for this 25 watt light bulbs or 40 watt flouresent lamps could be used (if only supplying light). If heating (brooding) is done by bulbs this may not be necessary when the light can reach all points of the brooder or housing. It is also important to have a uniform distribution of light inorder to have an even distribution of birds. The light should be given all 24 hrs for them to eat and drink throughout the day. In case

of cannibalism the intensity of the light should be reduced or coloured bulbs (red) could be used.

(5) VACCINATIONS:

This depends on the area and on the harvesting period of the broiler crop. If grown for shorter periods (6 wks) the requirements for vaccination may differ to the longer grown (8 wks) and still variable if it is grown for 12 wks. Generally Ranikhet vaccination (NCD) and sometimes Fowl Pox are the two possible vaccinations that are neeeded to our areas. Also care must be drawn accordingly to high risk and low risk areas to draw programmes for the vaccinations. It is betrer to consult the area Veterinarian / Poultry specialist to draw up a programme for your farm.

(6) COMMON DISEASES OF BROILERS:

Other than those mentioned for layer birds, the most common problem one can come across in broilers are the Respiratory diseases and Coccidiosis.

(a) Respiratory diseases can be due to chilling or other viral and bacterial agents or due to mycoplasma (pplo) organisms secondarily infected by bacteria. In this case care must be taken to run the temperature of the house (or brooder) efficiently according to the need and use some preventive threapy with antimycoplasmal drugs such as Tylan, Tiamutin, L nco - spectin, Vibravet, Erythromycin, Spiramycin etc. For secondary infections or in the absence of mycoplasma, Tribressen(Welcome), Furaltadone, Tetracyclines or other antibiotics or combinations of antibiotics could be used successfully.

(b) For Coccidia use latest anticoccidial drugs in feed as prevention such as:-

Monensin (Elancoban - Elanco) = 100 - 120 ppm,
Lassolocid (Avatec - Roche) = 75 - 125 ppm.
Salinomycin (Coxistat - Pfizer) = 60 ppm.
Aprinocid (Approcox - MSD) = 59 ppm.

Amprolium (Amprol 25% - MSD)
Colpidol (125 ppm)
D. O. T. etc.

Of these the first 4 are the latest and fall under ionophorus type of antibiotics (anticoccidials) which interfere with the ionophore of the coccidia in the ion transport through the membranes (unlike affecting enzymatic reactions that are sometimes by passed by the coccidia). These antibiotics (anticoccidials) are used in the daily feed, at least till the last week of the life of the bird.

GENERAL RECOMMENDATIONS FOR BROILER PRODUCTION:-

(1) STOCKING DENSITY:

The optimum density of birds per m^2 depends on;

(a) Environmental conditions.
(b) Climate of the area and the facilities available in the housing.
(c) Final weight of the broilers.

Under good conditions a maximum of 30 kg live weight per square meter may be calculated.

(2) DAILY CHECK:

(a) Distribution of birds.
(b) Health and mortality.
(c) Temperature.
(d) Ventilation.
(e) Feed and water (clean and replace).
(f) Light.

Cull the undeveloped birds and any others which are unable to reach feed and water. Weekly check weights of the birds in groups by random selection and compare with the standard weight performances specific to the breed, given by breeders.

(3) POLICY:

As much as possible apply "All in ALL out" policy ie: All the birds of a particular batch should come at one time to be housed and sold out together preferably on the same day.

WATER REQUIREMENTS (APPROXIMATE)

Broilers per 100 birds per day

Age (weeks)	U. S. gallons	British gallons	Liters
1	1.0	0.84	3.8
2	1.5	1.26	5.7
3	2.0	1,68	7.6
4	2.6	2.18	9.9
5	3.4	2.86	12.9
6	4.2	3.53	16.0
7	4.9	4.12	18.6
8	5.5	4.62	20.8
9	6.0	5.04	22.7
10	6.5	5.46	24.6

Note:-

The quantity of water intake may vary widely depending on the climatic conditions of the area. house temperature, feed, breed etc.

Growth Development and Feed Consumption of a GOOD BROILER

Age in weeks	1.	2.	3.	4.	5.	6.	7.	8.	9.
Weight at end of week, gr	142	330	580	880	1195	1520	1840	2155	2470
Average gain of weight per day, gr	15	27	36	43	45	46	46	45	45
Total feed consumption, gr	145	410	818	1375	2046	2813	3666	4605	5634
Average feed consumption/day, gr	21	38	58	80	96	110	122	134	147
Total feed conversion (Feed : live weight)	1,02	1,24	1,41	1,56	1,71	1,85	1,99	2,14	2,28
Feed conversion within each week (Feed/week : gain/week)	1,42	1,41	1,63	1,86	2,13	2,36	2,67	2,98	3,27

CHAPTER V I

PARENT STOCK MANAGEMENT

This chapter is not intended to provide all informations on parent stock management, as this department is again a vast and sclentific, that has to be dealt separately in another book. The aim here is to draw the attention of the practical poultrymen to some of the important points frequently overlooked to the detriment of flock performance.

(A) BROODING TILL INITIAL SELECTION:

(1) Ensure that the initial brooding temperature is not below 95° F (35° C). Reduce temperature by 5° F per week, but be influenced by the behaviour of the chicks which is the best guide to correct temperature.

(2) Cookerals and pullets should be brooded seperately. Allow about 1 sq. ft per chick (900 sq. cm).

(3) Supply a standard, specially formulated chick mash along with fresh clean water. If necessary add multivitamins and minerals to the drinking water occasionally

(4) Initial selection should be done at 8 wks of age.

(B) SELECTION:

This is important and as mentioned above, initially done at 8 wks of age. Remove obvious culls which should not exceed 3% and also any sexing errors. Pay special attention to weight, size, vigour and health, when reducing the number of cockerels down to 12 - 13 per 100 pullets retained. It is recommended that a

final cockerel selection should be carried out at 20 - 22 wks. The mating ratio should be 10 cocks per 100 pullets housed. If excessive pullet damage become apparent, the number of males may subsequently be reduced to 9 per 100 pullets.

(C) **INTENSIVE REARING AND FEEDING:**

(1) Provide about 2⅜ sq. ft (O. 25 sq. m) for each pullet with twice this amount for cockerels. Where adequate ventilation & temperature can be maintained, the allowance per pullet can be reduced to 2 sq. ft (O. 18 sq. m) and for cockerels 2 - 2½ sq. ft (O. 18 - O. 23 sq. m).

(2) Provide about eight 16 inch diameter (O.4 m) tube feeders per 100 birds or 3 linear inches (7.6 cm) per bird of trough or automatic feeder space.

(8) Ventilation must be capable of providing about 2 C. F. M. of air per pound body weight (O. 12 cu. m/minute/kg) and be controllable down to 10% of this level dependant of all house conditions.

(4) Cockerels if reared separately should have a generous perching space allowance. Keep them in small groups of about fifty to reduce fighting.

(5) The feed should be specially formulated according to the requirements.

FEEDING METHODS: (RESTRICTED FEEDING)
(Limited every day/skip every other day)

A profitable flock cannot be achieved without successful rearing and this in turn is largely dependant on carefully controlled feeding. By this the sexual maturity can also be delayed and can avoid many problems associated with precocity.

Control of feed should not be implemented unless the birds are healthy, uniform, free from diseases and a standard feed is available. It is essential to restrict both the cockerels and the pullets.. Some limitation of pen size to a maximum of 500 pullets is desirable.

The basic information necessary should consist of a statement of the amount of total protein and metabolizable energy required per pullet per day. After the pullets are mated each cockeral is assumed to have the same requirement as a pullet and the calculation should be carried out on the total surviving birds of both sexes. From peak production, intake requirements are governed more by the level of egg production than by age or weight. If the egg production differs from the average expectation then the intake figures must be adjusted accordingly.

The most reliable guide to the effectiveness of your chosen feeding programme is careful check on live weights every week and compare to the standard given by the breeders. Then as a rule increase or decrease the feed allowance by the same percentage that the birds are under or over weight respectively. If a flock has become extreamly uneven in body size and sexual development it should be subdivided by weights into two flocks and each of which is treated separately according to the body weights.

The level of drug inclusion in the ration; especially coccidiostats must be such that, each bird's daily intake of feed gives it the amount of drug required to be effective. Coccidiostat feeding should be discontinued at 15 - 16 wks of age.

The chick starter ration should be fed ad - lib and gradually changed to growers ration at about 35 days of age. Upto mating (normally at 20 - 22 wks) cockerels reared seperately require a special programme. After mating feeding is covered by the recommendations for the pullets. It is important not to allow the weight of the cockerels to fall below the recommended levels if a high level of fertility is to be maintained; after mating. Always adjust feed depending on feed intake which may be affected by environmental temperature or disease problems and correct the rate of growth of the birds.

Equipment & feeders must be carefully spaced to allow room for mating activity (2¾ sq. ft/bird allowed but this could be reduced to 2¼ if good ventilation & temp can be maintained in the house).

It should be noted that the controlled feeding should be applied only during the rearing period and programme employing a

scratch feed of grain should be fed "controlled". The total feed allowance for 2 days should be divided with all the mash being fed one day, early in the morning and scratch feed or grain on the alternate day.

LIGHTING PROGRAMME: (Closed Houses)

For parent stock efficient lighting programme is highly recommended and they can start from the 2nd day of age as follows:-

(1) The birds start off for the first 2 days on 24 hrs of light (through out).

(2) Reduce light to 18 hrs on the 3rd day.

(3) From 4th day to 4th week the lights could be gradually reduced by even stages from 18 hrs to 10 hrs of light.

(4) From the 4th to 20 th / 22 nd week light is kept constant at 10 hrs.

(5) From 20th/22nd week the light should be increased by 1 hr per week to reach 16 - 17 hrs by 27/29 weeks and there after remain constant until the end of lay.

(6) Never allow total amount of light to decrease after 22 weeks of age or to increase from D/O up to 22 weeks.

(7) It is essential that your house should be completely light proof in order to effect complete control over the sexual maturity.

(8) If natural day light can interfere; a special pragramme for lighting must be worked out with your Veterinarian/ Poultry specialist or a rough programme given for commercial layers in the earlier chapter could be used.

VACCINATION, DISEASE CONTROL AND DISINFECTION

Many poultry diseases may be prevented by good management and high standards of hygine.

For diseases like Ranikhet (NCD), Mareks disease, Fowl pox, Fowl cholera, Gumboro etc, Vaccinations are necessary. The recommended details vary from place to place and a programme

suitable for a particular area should be drawn up in conjunction with your Veterinarian.

Complete depopuiation and thorough disinfection between consecutive batches of birds is vital.

CARE OF HATCHING EGGS.

(1) Collect eggs 5 times daily and place them in the egg store immediately after collection and fumigate before cooling and packing. This necessitate a small fumigation chamber within the egg room. The eggs should be packed 24 hrs after collection and must not be washed or wiped by a wet cloth as this is detrimental to the hatchablity and spread of disease.

(2) Humidity of the egg room should be around 75 - 80%. A tray of water can help to increase humidity.

(3) Good litter management & clean egg boxes are essential for the prevention of dirty eggs. Floor eggs should not be sent to the hatchery which may depress hatchablity and act as source of disease.

(4) Keep nest boxes in the floor of the house around the 1st week of lay and after 2 - 3 wks in lay; increase the height of the boxes gradually and after another 3 wks put them at full height (max 18 inch above litter). Locate the nests in the darker part of the house where floor eggs tend to be laid. Provide one nest for 4 pullets with ample nest litter adding twice weekly. This will prevent floor & dirty eggs.

(5) The refrigeration temp of the egg holding room in the hatchery should be around 65° F (18. 3° C).

(6) Do not hold hatching eggs in excess of 7days as hatchability will decline and leg problems may occur in chicks.

CHAPTER VII

POULTRY NUTRITION & FEED FORMULATIONS

Nutrition is again another vast, scientific, and complex subject which cannot be expressed entirely in a chapter. However some of the basic fundamentals of poultry nutrition are mentioned here to the farmers, so that they can have some knowledge about efficient and economical feeding of the birds.

The nutrient requirements of poultry are derived from several research to get at the adequate levels for normal growth, health and productivity with emphasis to economics. However factors like varying nutrients of feed ingredients, differing feed mixing and storage conditions may reduce nutrient levels to below those intended. In addition to this the varying environmental temperature and some other physical conditions can also bring in variations for requirements. As such feed formulators may wish to add "margins of safety" by increasing the levels than the actual requirements.

(a) ENERGY REQUIREMENT:

The energy repuirement of a bird can be directed on three:-

(1) Basal metabolism of the bird.

(2) Normal activity of the bird.

(3) Special activity of the bird.

The basal metabolism is the minimum energy required for the bird to maintain its systems of the body other than voluntary

activities, action of enviromental temperature and also the feeding process. The energy required for activity can vary considerably and is usually estimated as about 50% of the basal metabolism in poultry.

In poultry, the metabolisable energy requirements and the protein requirements are interdependant and most poultrymen and feed manufacturers express the available energy for poultry diet on the basis of nitrogen equilibrium. It is difficult to establish the energy requirement per unit of feed since birds adjust their feed intake in an atempt to satisfy energy needs. Temperature of the environment has effects on energy requirement. In cold climates more energy is liberated from the body metabolism inorder to maintain the body temperature around the constant. On vice versa in hot climates the birds will need lesser burning of carbohydrates in the body as there will be no need to raise its body temperature.

(b) PROTEIN REQUIREMENT: Aminoacids)

In poultry the protein requirement is also stated in relation to the energy level of the diet and the degree of fat deposition desired if necessary. The calories is to protein ration concept extends to aminoacids. Some of the aminoacid requirements given in the tables at the end of this chapter were established by direct experimentation, while other values were calculated, assuming the aminoacids requirement to be proportional to the protein requirement. The thirteen aminoacids given in the table are considered to be essential for poultry. For glycine to be synthesized by poultry; there must be enough dietary serine present. Cystine and tyrosine are considered essential even though they can be replaced by methionine and phenyl alanine respectively. In relation to aminoacids and vitamins in practicai feed formulation; methionine can spare choline as a methyl donar, and tryptophan can be used to synthesize niacin. But it is more economical to supply these two vitamins in the diet directly than depending on aminoacids supplied in the feed for the above purpose.

(c) VITAMINS:

Vitamin requirements are presented in the tables at the end of this Chapter. It is always advicable to store and add, s perately

the vitamins mixture rather than in combinations with the minerals for better stability and activity.

(d) MINERALS:

The essential minerals are also given in the table. Calcium requirement of laying hen is difficult to define. Adding too much calcium to diets interferes with the utilisation of several other minerals and fat, and tends to reduce the palatability of the diet along with roughing of egg shells. The calcium requirement in the feed for laying hens should be varied with the environmental temperature as the feed intake, varies with the external temperature. If egg shell quality is a problem during hot weather and if the pullets have come into production at a fairly young age and have peaked very quickly, it may be advisable to increase the levels of calcium by O. 25% beyond that given in the normal diet. Recent work has shown that a marked improvement in shell quality can be obtained by feeding part of the dietary calcium seperately as oyster shells or lime stone chips.

RATION FORMUALTION

The formulations and mixing of feeds is a highly technical job involving the use of an increasing amount of knowledge, experience in purchasing ingredients, experimental laboratory and field testing and also the use of computers nowadays. Since feed is the largest cost in producing poultry meat and eggs, special consideration should be given to obtain maximum efficiency of production. It is not enough to formulate a diet that is nutritionally sound but economically unsuitable. To be economically sound a diet must result in the "least - cost" per kg of meat or per dozen eggs produced in a specific period of time which in most, but not all cases, would be the shortest period of time. In the past, many poultry producers have looked to feed conversion as a sign of feed quality. Although feed conversion will generally be an indication of diet quality, it is not necessarily an indication of the most economical diet. The cost of producing a dozen eggs or a kg of meat is the only two criterion for evaluating a diet and feed manufacturers should stress this point when discussing feeding programmes with producers.

These days computers play a big role in feed formulation to the nutritionists. A computer is only as good as the data fed into it. But the nutritionist who feeds data should have a good basic background in fundamental and practical nutrition to provide accurate data for the computer and to evaluate properly the computer derived formulae. In many cases diets formulated strictly by the computer have not met with success because they have not been evaluated well by the nutritionist who learnt from experience which cannot be properly programmed into computer. However the speed with which a computer can formulate a diet and the strict check on the level of each dietary nutrient cannot be matched by manual calculations.

POINTS TO BE CONSIDERED IN RATION FORMULATION

(1) Class of poultry and economics (chicks, growers, layers, broiler, starter finisher parent stock etc).

(2) The environment, housing and management facilities.

(3) The level of metabolisable energy and utilizable protein requirement ratios along with aminoacid availablity.

(4) The vitamins and minerals requirement and stablity of individual items.

(5) The daily feed intake in relation to environmental temperatures and other stress factors.

(6) The bulk, fibre content, palatability and digestibility of the finished feed

(7) The use of manual calculations or computers.

(8) Feed mixing methods and efficiency of personal.

(9) Physical from of the diet (mash, crumble feed, pellets).

(10) Required ' margin of safety" to essential ingredients.

(11) Feeding practices and programmes.

FEEDING PRACTICES OR PROGRAMMES

(1) Complete feeding methods (fully fed/adlib)

(2) Restricted feeding - daily (rations/quota)

(3) Every other day feeding + grain feeding (rationed for 2 days) (Parent stock - growing period)

(4) Phase feeding (different ingredient percentages to different time and age).

MIXING FEED (PREMIXES)

The direct addition of vitamins, minerals, antibiotics or other supplements to feed is not a correct method of mixing feed. These must be often included at 1 kg/ton or less; as these microingredients should first be suitably premixed so that atleast 5 kg/ton is added to the feed.

It is generally recommended that vitamin, mineral premixes be added to the mixer when about one half of other ingredients have been included. It is usually suggested, that mixing for a minimum of 7 minutes for horizontal mixtures and 15 minutes for vertical machines. However this can vary with the type of mixer and the manufacturer's instructions should be followed. The diluent suggested for the vitamins, mineral premixes etc. is ground maize at medium grind for best results. If the carrier is too course it is not possible to obtain good distribution of the supplement. If too fine a carrier, leads to dustiness and caking.

FEEDING METHODS

It should be noted that many good feeds in the market are not performing satisfactorily, simply because they are not being used to the best advantage. Thus feed manufacturers should inform poultry men adequately of the correct feeding method to be employed with each of their products. Regardless of quality of feed, maximum efficiency of production will not be achieved unless the producer gives careful consideration to management, breed and disease control. In a bock such as this it is impossible to present all the different formulations and other details which will result, in the most economical diet under all conditions and at various times of the year. An attempt has been made to help the farmers; only as a guide and it is always advisable for small holders and the less experienced farmers to buy feed from reputed manufacturers until the size and experience demands to have their own feed manufacturing plants. Other than this, one can try to use these hints to produce feed only in emergencies. The analysis of ingredients and tentative emergency formulations for different class of poultry has been given in the tables at the end of this chapter.

APPROXIMATE NUTRIENT REQUIREMENTS FOR POULTRY

RATION	METABOLISABLE ENERGY Kcal/Kg	CRUDE PROTEIN %	CALCIUM %	AVAILABLE PHOSPHORUS %	LYSINE %	METHIONINE %	SALT %	ESSENTIAL FATTY ACIDS %
1. CHICK	2750–2800	18	0.9	0.45	0.95	0.35	0.4	0.8
2. GROWER	,,	15	0.9	0.4	0.65	0.3	0.4	0.8
3. LAYER	,,	16–17	3.5	0.35	0.30	0.35	0.36	1.1
4. BREEDER (Layer)	,,	17	3.5	0.35	0.8	0.35	0.36	1.4
5. BROILER (Starter)	3040	21	1.0	0.45	1.15	0.57	0.4	0.8
6. BROILER (Grower)	3080	19	1.0	0.43	1.0	0.5	0.4	0.6
7. BROILER (Finisher)	3080	18	1.0	0.4	0.9	0.45	0.4	0.5
8. BROILER (breeder)	2750–2800	16	3.4	0.34	0.75	0.35	0.35	1.4

APPROXIMATE NUTRIENT REQUIREMENTS FOR POULTRY

RATION	Vit A iu/Kg	Vit.D_3 iu/Kg	Vit. E. iu/Kg	Vit.K_3 mg/Kg.	Riboflavin mg/Kg	Thiamine mg/Kg	Choline mg/Kg	Vit. C mg/Kg
1. Chick	15000	2000	30	3	8	3	1500	150
2. Grower	10000	2000	25	2	6	3	1300	60
3. Layer	10000	2000	30	2	6	3	1100	200
4. Breeder (Layer)	15000	2000	30	3	8	3	1500	200
5. Broiler (Starter)	10000	2000	30	3	8	3	1500	150
6. Broiler (Grower)	10000	2000	25	2	6	3	1300	60
7. Broiler (Finisher)	10000	2000	30	3	8	3	1500	60
8. Broiler (Breeder)	15000	2000	30	3	8	3	1500	200

APPROXIMATE COMPOSITION OF COMMON FEED AND MAXIMUM INCLUSION LEVELS

INGREDIENTS	Metabollsable energy (Kcal/Kg)	Crude Protein %	Crude Fat %	Crude Fiber %	Calcium %	Available Phosphorus %	Methionine %	Cystine %	Lysine %
1. Maize	3388	9	2.5	2.4	0.1	0.08	0.2	0.1	0.2
2. Rice Bran	1910	12.2	13.4	11.4	0.08	0.4	0.2	0.1	0.5
3. Rice Polish	3307	11.0	13.0	4.0	0.04	0.04	0.2	0.1	0.5
4. Coconut Meal	1540	20.0	8.0	11.5	0.2	0.2	0.3		0.64
5. Coconut (expeller)	1540	20.4	8.6	12.0		0.3			
6. Soya Meal	2491	44.0	0.5	7.0	0.25	3.0	0.6	0.6	2.9
7. Fish Meal (65–70%)	2800	65-70	8.0	1.0	5.5	0.5	1.8	1.1	5.8
8. Gingellypoonac	1984	44.0	5.0	5-0	2.0	0.8	1.5	0.6	1.4
9. Skim Milk Powder	2684	35.0	2.3		1.15		0.75		2.5
10. Broken Rice	2679	7.3	1.7	10.0	0.04	0.1	0.1	0.1	0.2
11. Biscuit Meal	3740	8.0	18.0	4.5	0.44	0.7	0.2		0.3
12. Bone Meal		7·5			28.9	12.6			
13. Lime Stone					38.0				
14. Bread Waste	3530	11.0	1.0	0.5	0.05	0.03	0.2		0.3
15. Tallow	7000	—	95.1						

APPROXIMATE COMPOSITION OF COMMON FEED AND MAXIMUM INCLUSION (VITAMINS)

INGREDIENTS	Vitamin A (in/Kg)	Riboflavin (mg/Kg)	Thiamine (mg/Kg)	Pantothenic Acid (mg/Kg)	Niacin (mg/Kg)	Biotin (mg/Kg)	Folic Acid (mg/Kg)	Essential Fatty Acid %	Choline (mg/Kg)	Maximum inclusion Level in Sri Lanka%
1. Maize	2420	1.3	4.4	5.3	21.3	0.07	0.2	1.9	660	60
2. Rice Bran		2.4	22.8	22.0	286.0	0.42	2.2	3.4	1254	20
3. Rice Polish		1.8	19.36	57.2	528.0	0.62	0.2	3.3	1320	10
4. Coconut Meal										30
5. Coconut (expeller)										10
6. Soya Meal	2.0	3.1	6.2	14.5	26.6	0.31	0.7	0.4	2640	35
7. Fisn Meal (65–70%)	17.6	4.8	0.66	8.8	55.0	0.2	0.24	0.5	2860	12
8. Gingellypoonac		3.3	2.9	5.5	13.2	4.4	0.51	1.8	1496	20
9. Skim Milk Powder										5
10. Broken Rice		1.1	2.86	8.8	28.6	0.9	0.24	0.63	990	10
11. Biscuit Meal										10
12. Bone Meal										1
13. Lime Stone										4
14. Bread Waste										5
15. Tallow								2.5		3.0

SOME POULTRY FORMULATIONS USING COMMON INGREDIENTS IN SRI LANKA

INGREDIENTS	Chick Mash (Commercial) %	Growers Mash (Com) %	Layers Mash (Com) %	Broiler Starter (Com) (%)	Broiler Finisher %	Super Layer %	Super Broiler Starter %	Super Bro Finisher %	Approx Price Per Ton Ingredients
1. Maize	40	40	40	45	47	42	44	47	4500/=
2. Coconut Poonac	26	25	25	18	18	19	18	15	4800/=
3. Rice Bran-I (Polish)	10	10	09	10	09	10	10	10	2500/=
4. Rice Bran-II	10	15	09	06	06	08	04	04	1000/=
5. Fish Meal 65%	04	03	04	06	05	05	07	06	18,000/=
6. Soya Meal 44%	08	05	04	06	06	06	09	08	8,000/=
7. Gingelly Poonac 44%	—	—	04	06	04	05	04	04	7,500/=
8. Bone Meal	0.5	0.5	1.0	01	01	01	01	01	2,500/=
9. Shell Grit	1.5	1.5	4.0	02	02	04	02	02	900/=
10. Fat/Oil/Tallow	—	—	—	—	02		—	03	10,000/=
11. Salt (gms/25 kg)	20	20	20	20	20	20	20	20	—
12. ★Premix	★	★	★	★	★	★	★	★	—
13. □Coccidiostat	★	★	—	★	—	—	★	—	—
14. ‡‡Broken Rice (Optional)	(5)	(5)	(5)	(5)	(5)	—	—	—	—

Note: ★ **Premix** Should be used according to the manufacturers (reputed).

□ **Coccidiestat** used may be Amprol plus for chicks and growers. while metichlorpindol for Broilers according to the manufacturers.

‡‡ **Broken rice** could be included for a maximum of 10% in place of expensive energy yielding grains if necessary to reduce the cost of feed.

CHAPTER VIII (A)

DISEASES OF POULTRY (GENERAL).

(I) THE NATURE OF DISEASE:

Disease may be defined as any condition that interferes with the normal performance of the birds, animals, plants or men. Disease could be divided in to two major categories as.

(a) Infectious diseasees.
(b) Non infectious diseases.

Infectious diseases are due to living organisms such as bacteria, viruses, protozoa, fungai or parasites. Non infectious diseases may be management related, nutritional deficiencies, poisioning or genetic.

In commercial poultry, majority of health problems are concerned with management such as over crowding, temperature, ventilation, lighting, availablity of feed and water, litter management and general sanitations.

The objective of poultry disease control, both infectious and non infectious should be prevention. Mostly curative treatments are carried out late if diagnosis is not done in time and losses may result. The preventive actions for disease control includes proper vaccinations, premedications and good management.

WAYS BY WHICH DISEASES SPREAD:

(I) Embryonic (Egg) transmission:

Adenoviruses, Avian encephalomyelitis, CRD, EDS, Synovitis (Mycoplasma), Pullorum-Typhoid, Salmonellosis, Viral Arthritis.

(2) Hatchery diseminations:

Aspergillosis (Brooder pneumonia). Yolk sac Infection, Staphylococcosis (part)

(3) By premise Contaminations:

Gumboro, Mareks, Salmonellosis, Coccidiosis, Staphylococcosis.

(4) By Respiratoay or Airborne:

CRD, Avian influenza, IB, LT, Mycoplasma synoviae, NCD (Ranikhet).

(5) By Carriers:

Eg: CRD, FC, Fowlcoryza, Pullorum - typhoid IB, LT' Lice, Mites, NCD, Mycoplasma synoviae, Salmonellosis

The carrier state of Fowlcholera, Fowl coryza, Pullorm - typhoid, CRD, Mycoplasma Synoviae and Solmenellosis is life long where apprantly recovered birds can transmit the disease to healthy birds for the remainder of their lives. The carrier state of IB is more limited and persist for no more than 4 - 10 wks. The virus of NCD does not remain long in recovered birds. But the virus cycles from bird to bird, and may persist in apparently recovered flocks for many weeks. As such one should take all possible precautions in transferring growing or adult birds from one premise to another.

(6) By vectors:

A vector is anything that serves to carry a disease producing agent from one premise to another. The people who circulate between premises as Managers, Inspectors, Labourers, Visitors, Drivers etc may become contaminated with infectious agents and may carry to other premises. Contamination occurs i two different ways depending on the way the infective agents come out from the infected bird. The agents of the respiratory diseases are put out in the air and contamination occurs on one's clothing, hands, face, cap etc. On the other hand the agents of some other diseases are in the droppings and contamination occurs on shoes, feet, or boots. The use of foot bath or disposable plastic boots will aid in the prevention of these latter diseases but not the respiratory diseases.

Similarly contaminated equipments which circulates between farms such as feed sacs, egg, cartons, bird crates etc can also serve

to spread disease. Others like Rodents, Mosquitoes, Ticks, Free flying birds etc. can transmit. For Eg. Fowl pox (mosquito transmitted); Spirochetosis (ticks) and diseases caused by external parasites (birds).

(7) By Contaminated Feed or water:

The most important in this group is Mycotoxicosis, due to the formation of toxins or poisions in feed stuffs as a consequence of mold growth. Contaminated water can produce Fowl cholera and Fowl coryza.

FUNDAMENTAL FACTORS OF DISEASE PREVENTION IN POULTRY

1. Preventive medicine should be the main approach which will either completely prevent or decrease the severity of a disease.
2. Have an effective programme for cleaning and disinfection
3. If necessary sanitize poultry drinking water.
4. Select disease free chicks and buy from reputed hatcheries or farms that are famous for healthy stocks.
5. Keep separately the hatche y, layer operations and broiler units preferably using birds of one origin.
6. For broilers and commercial layer operations, have single age with "All in All out" policy.
7. Never transfer birds from one commercial operation to another.
8. Control movement of persons and equipments.
9. Use foot bath and farm uniforms.
10. Provide adequate well balanced feed and fresh water.
11. Dispose dead birds and culls preferably by burning.
12. Provide good management for conditions like Temperature, Ventilation, Humidity, Litter, etc.
13. Have a sound vaccination programme and follow it carefully.
14. Always get the dead birds examined and diagnosed in the laboratory.

15. Have some stock of medicines and vaccines in the farm for any emergencies.

POULTRY VACCINATIONS (GENERAL)

Vaccination is innoculation with a specific biological substances (Antigens) to stimulate resistance or immunity to a particular disease. This stimulates the body defence mechanisms to produce antibodies that can attack the antigen (disease producing organisms).

Reliable immunity can be obtained when vaccination is given under optimal conditions, that is when the vaccine is handled, stored, and administered properly; the birds are susceptible, healthy, vigorous with adequate nutrition and parasite free. It is also essential to have a good environoment and timing.

In poultry, scientist have developed weakened (attenuated) forms of viruses that stimulate antibody production with little danger of causing the disease while vaccinating. Even killed viruses of certain diseases stimulate the production of antibodies and are sometimes used in this industry. Otherwise live-viruses in very small quantities are also used in vaccine productions. Among the disease producing organisms viruses stimulate better development of immunity; and as such in poultry, most of the virus diseases have effective vaccinations.

After vaccination the so-called VACCINATION OUT BREAKS (post vaccination reactions) may occur. During this time antistress substances like Multi-Vitamins, Minerals, aminoacids and some times even antibiotics could be given preferably in drinking water. Some people even use antifebrile and other supportive drugs along with the antibiotic and vitamin combinations.

MECHANISM OF IMMUNITY

Immunity is the condition of being immune or resistance and is specific for each disease. It is a part of the body's defence against infections. Mechanisms of immunity can be classfied as follows:-

(1) **Inherited Immunity:** This is a natural resistance characteristic of the species, strain, breed, race or individual.

Eg: Lymphoid leucosis resistant and susceptible lines of birds can be obtained by genetic selection.

(2) **Acquired immunity:** This is provided by antibodies which develop when the individual is exposed to the disease agent. This could be subdivided into:-

(a) Active acquired immunity which is achieved by recovery from the disease or by response to vaccine.

(b) Passive acquired immunity. That is achieved when antibodies are passed from the parents via the egg (parental immunity) or by antiserum injections.

Many infectious agents are said to be host-specific, that only a single closely related species provide the internal environment required by the disease agent for Eg: IB, ILT, and Infectious coryza are only specific to chickens All other species have complete immunity to these diseases.

Antibodies do not have equal longevity or life expectancy. Some, like those of NCD (Ranikhet) may last only a few months while those of Fowlpox may protect for lifetime Likewise the bird's ability to develop long lasting antibodies varies with age. For most diseases, the chicken must be 6 weeks old or more to develop long lasting antibodies. For this reason vaccinations for certain diseases are delayed until the birds reach 6 weeks of age or they are revaccinated between 6 weeks of age and maturity. Knowledge of the longevity and the age of immune-competency of an antibody is important in selecting the best age and the interval for repeat vaccination against diseases.

Parental antibodies have life expectancies of 3-4 wks and will protect, only for that length of time. Parental immunity often interferes with the development of active immunity Thus repeat vaccinations (boosters) are recommended to give strong and longer lasting immunity especially when the birds are vaccinated early in their life. Parental immunity varies widely in chicks depending upon the immune status of the parents.

This is also a very important point for planning vaccination programmes especially at high risk areas where vaccines are given during the period of parental immunity when some or all the vaccines will be destroyed (or neutralized) and there will be an impaired immune response.

IMMUNO COMPETENCE (IC):

The capacity of the individual to produce antibodies is termed "Immuno Competence" (IC). The young of all species have limited or no capacity to produce antibodies. IC begins to appear at about the 7th day and strengthen with age and is maximum at about the 6th wk of age.

IMMUNE SYSTEM (IS)

The Immune System in poultry is under the control of two glands namely the Bursa of Fabricius and the Thymus. The former controls the antibody production and is important in the resistance against viral diseases. The thymus controls "cell-mediated" immunity and is important in the control of bacterial diseases.

A pair of Harderian glands that is just behind the eyes in the medial aspect of the orbit, also play some part in the development of antibodies especially when vaccines are sprayed to chicks or by eye drop method. When aerosal NCD vaccines are applied, the epithelium of the respiratory tract reacts to give cell mediated immunity within 3 - 4 days.

IMMUNO SUPPRESSION:

Damage to the bursa of fabricius or thymus or both, interferes with the functioning of the immune system. Diseases like Gumboro and Marek's disease affect the bursa and Mycotoxicosis affects the thymus. If the bursa is affected there is diminished antibody production and the birds may loose the ability to resist against the viral diseases. This type of suppression of the activity of the bird is called immuno suppression, and Gumboro disease can be called Immuno suppressant, This secondary effect is more important than the Gumboro disease

itself to the bird, which ultimately destroys the ability of antibody production against many other diseases.

Marek's disease also attacks and damages the bursa and it is known to increase the severity of coccidiosis and CRD. Mycotoxicosis by damaging the Thymus can bring increased susceptibility to colibacillosis and staphylococcosis.

IMMUNO STIMULATION :

Some factors are supposed to increase antibody production and help the bird resist disease.

(1) Dim lighting increases the resistance of birds to viral diseases such as NCD (Ranikhet) but decreases resistance to bacterial disease such as Colibacillosis.

(2) Vitamin E supplementation in excess of growth requirements improves antibody production.

(3) Birds can be genetically selected for greater resistance against certain diseases.

ADMINISTRATION OF VACCINE :

There are about four common ways of administration of vaccines and the application varies with the need and the type of vaccine used.

(1) **Aerosal adminstration**: Here the birds are made to inhale the vaccine in fine spray. This is one of the most effective methods of vaccination for NCD and can be used in open houses when the air is still, using specially made machines.

(2) **Eye drop administration**: This is satisfactory and generally problem proof method of administration.

(3) **Administration in water**: This is the least effective method of vaccination, but is commonly used because of easy administration. This method may be used to condition birds for stronger vaccines. During this adminisration, disinfectants should not be available in the water and about 500 gms of powdered milk to 200 litres of water should be added to protect the vaccine against residues of disinfectants and adverse pH reactions. Pasteurized whole milk may also be used. See that

every bird gets its dose of vaccine. If necessary water should be withheld for a few hours so that the birds go for the vaccine with little thirst.

(4) **Administration by injections:** This is the common way of vaccination in our country because of the smaller size of the farms. In this vaccination the bird is more sure to get its correct dose, if administered by experienced personnel.

REVACCINATIONS (BOOSTERS):

Immunologists have shown that antibodies from a single inoculation are monovalent, compared to multivalent antibodies produced from 2 or more inoculations. The multivalent antibodies have a wider activity range against invading agents; have a longer life expectancy and reach a higher antibody level. The longevity of the antibodies varies from disease to disease. The life expectancy of NCD and IB antibodies is 3 and 4 months respectively. This life span dictates the interval of booster vaccinations. Revaccination of breeder flocks helps to assure high parental immunity of their progeny. In layer flocks revaccination prevents production losses from field outbreaks.

Unless there is a problem on a particular farm, vaccination for diseases such as LT, AE and FP should be delayed until the birds are atleast 6 wks old. Early vaccination for NCD and IB produces only short term immunity. However, since most flocks can experience field out breaks for these two diseases, (if vaccination is withheld to 6 wks of age), it is advisable to vaccinate for these diseases at 10 and 35 days of age. Then revaccinate at 12-16 wks of age and at 90 days intervals thereafter.

VACCINE TITRE:- (Eg. 10^6 EID_{50}) means, the amount of virus in 1 ml of the product. ie. Howmany times the original virus can be diluted and still infect 50% of the chicken embryo when injected into fertile eggs. This is generally given in logarithms to the base 10 (Eg. 10^6 means land 6 zeros = 1000,000).

HI TITRE:- HI Titre is expressed as the last serum dilution where haemagglutination is inhibited; times the number of HA units used. (1:64 - non specific NDV, 1:640 - Resistant birds, 1:1020 - Multiple vaccinated).

CHAPTER VIII (B)

COMMON DISEASES OF POULTRY AND PREVENTIONS

( ) NEWCASTLE DISEASE (NCD/RANIKHET)

This is caused by a virus which is highly contagious and spreads rapidly even through air. There are two distinct forms of NCD namely.

(a) **Endeimic Newcastle Disease** (Pneumoencephalitis)

(b) **Viscerotropic Velogenic Newcastle Disease** (Asiatic ND)

(a) **Endemic Newcastle Disease**: This is an acute rapidly spreading contagious respiratory disease of birds of all ages. This is caused by a virus and characterized by respiratory distress (gasping) or encephalitis or both. This is highly fatal to young chicks and causes a severe drop in egg production in laying flocks.

This disease is transmitted by air or introduced by contaminated shoes, feed sacs, crates, care takers, visitors, tyres of the vehicles and wild birds. Poorly cleaned houses and dead birds are potent sources of the virus.

SYMPTOMS: The onset is sudden and rapidly spreading through the flock. Discomfort, watery discharge from the nostrils, respiratory noises, laboured breathing (gasping), paralysis, trembling and twisting of the neck may also be seen. Mortality in young and susceptible chickens ranges from 10-80% depending on the virulence of the field virus. In adult birds

the symptoms may be loss of appetite, decrease of water consumption and dramatic drop in egg production even up to zero. This diseas runs its course in 10-days, but production is not regained for 5-6 wks.

LESIONS: Facial sweling in young chicks, congestion and haemorrhage in all tissues, cloudy air sacs, exudates in the lungs, wind pipe and airsacs. Degeneration of undeveloped eggs in the layer hens, are also seen.

DIAGNOSIS: History of rapid onset, symptoms, lesions and laboratory findings.

TREATMENT: Non specific, can use antibiotics for 3-5 days to prevent secondary bacterial infections.

PREVENTION: Vaccination, Good sanitation, and Isolation.

(b) **Viscerotropic Velogenic Newcastle Disease**: This is an explosive hyperacute, contagious form of NCD that affects all species of birds including poultry. This is caused by a velogenic (extremly viruleut) ND virus with very short incubation period (3-5 days) in susceptible poultry. The virus attacks the internal organs causing acute blood poisoning characterized by extensive haemorrhage, prostration and deaths This virus can survive for several weeks in materials such as feathers, droppings and broken eggs. The virulence of this virus tends to subside as the disease spreads in a bird population and even becomes chronic and endemic when the birds have some natural resistant to it.

All species of bird, man and other mammals are susceptible to these virus. In man mild respiratory ailments may be seen. All recovered birds remain carriers and can shed the the virus to the new incoming birds.

The virus can be airborne or introduced by vectors.

SYMPTOMS: The birds may die before symptoms appear. Infected birds become listless, breath heavily and become weak. They develop a watery, greenish, blood stained diarrhoea.

Sudden drop in production and malformation of shells and yolks may be seen with the laying birds.

LESIONS (P. M): Facial swelling with haemorrhages in the mouth, nostrils, and cloaca. Marked and extensive congestion and haemorrhage of all tissues, prolonged blood clotting time, exudation of air passages and the G. I. tract, Pulmonary consolidation, swollen and dark liver and sloughing of intestinal mucosa may also be seen.

DIAGNOSIS: History, rapidity of onset, symptoms, and lesions together with laboratory diagnosis.

TREATMENT: None

PREVENTION: Vaccination with Lasota type of ND Vaccine at 70 to 90 days intervals. Depopulate the entire infected flock, good cleaning and disinfection should follow and if necessary rest the farm.

VACCINATION AGAINST NCD (RANIKHET): All commercial birds should be vaccinated against NCD. Programme must be drawn and adopted to areas on local circumstances.

NCD VACCINE: A number of vaccines have been developed and they vary widely in potency. To be effective, live virus vaccines must produce some reactions in birds, (mild or strong). The strong vaccines are better immunizing agents, but can kill chicks. In Sri lanka the vaccine produced by the Vaccine Production Centre/Peradeniya provides an effective vaccination to our birds if done according to the instructions. However transport, storage, dilution and skill in administration are limiting factors in the field.

TIME OF VACCINATION: In epidemic situations where disease exposure is probable, eariy vaccinations are necessary. Since the virus is airborne, there is a common concept that NCD is always a high risk disease and it is better to take necessary precautions according to the advicce of the area Veterinarian. Generally in Srilanka farmers are adviced to have the initial vaccination at about 3-4 wks (½ dose) and a booster (2nd vaccination) around 3 months of age by I/m injections.

MONITORING VACCINATION PROGRAMMES: For the full control of NCD, immunity must be maintained. This requires multiple vaccinations particularly for replacement birds and it is always better to evaluate vaccination programmes in the laboratory using the blood by haemagglutination - inhibition test (HI test).

Management Factors in New-castle disease Controll:

1. Chicks should be free from chronic respiratory disease which seriously complicates the use of live virus vaccines.
2. All chicks at day old should posses parental antibody against Gumboro disease.
3. Out breaks of NCD in vaccinated birds, severe or mild should be re-evaluated for the vaccination programme.
4. Depopulate flocks completely prior to the introduction of new birds if there is residual infection.

(2) **FOWL POX (FP):**

This is relatively a slow spreading viral disease in poultry of all ages characterized; in the dry form by cut enous (skin) lesions and in the wet form by diptheretic throat lesions. The wet from causes respiratory distress by obstructing the upper air passages.

This is transmitted by air or infected mosquito and possibly by the ingestion of infective scabs. Mosquitoes become infected by feeding on birds with fowl pox in the blood stream.

Symptoms: Raised wart like lesions on the unfeathered areas such as head, legs and vent. Unthriftiness, retarded growth, drop in production etc.

Lesions: Scabs may be seen at the corners of the eyes, mouth, nostril, comb, vent and shank, in the case of dry form.

Diagnosis: History, symptoms and lesions.

Treatment: Vaccinate to stop out breaks. Treat pox lesions topically with silver nitrate and give antibiotics in water for 2-3 days to combat secondary bacterial infection.

Prevention: Vaccination at about 8 - 10 wks of age in low risk areas. Control mosquitoes and sources of infection coming in.

(3) COCCIDIOSIS:

Coccidiosis is a disease that can occur in any bird group maintained in contact with its own dropings. This is an intestinal disease caused by a large group of protozoan parasites termed coccidia. In chicken coccidiosis represents about 9 separate diseases due to 9 different coccidian species and each occurs in a some what different portion of the intestinal tract. Out of these 6 species are highly pathogenic, but only 3 are important for farmers.

NATURE OF COCCIDIOSIS: The infectious agent of coccidiosis is the oocyst which is a small microscopic egg like body shed in the droppings. Each infected chicken shed millions of oocysts and they must undergo a development stage known as "sporulation" before they become infectious. Sporulation is completed within 18 - 36 hrs and requires a temperature of about 20 - 32° C, moisture and oxygen. Unsporulated oocyst survive in premises for many months and are resistant to disinfectants. Infection occurs upon the ingestion of oocysts and in the intestinal tract (epithelium) further development continues and reproduction takes place both sexual, and asexual liberating spoozoites that can again attack new epithelial cells. The entire life cycle of coccidia lasts for 7 - 9 days and includes 8 stages. The multiplication, liberation and entry of sporozoites cause rupture and damage on the lining of GI tract and the bird starts to show the symptoms of the disease.

This is predominantly a disease of young poultry. However serious outbreaks occur in mature susceptible birds. Interspecies - infection dosenot occur because coccidia are species - specific. Recovered birds have some immunity but it is short lived unless the birds are in continual contact with coccidia. Immunity to one coccidial species will not protect the host from other species. The severity of coccidiosis is related to the number of oocysts consumed.

Transmission of this disease occurs from contaminated droppings and litter to susceptible birds (litter borne). It does not spread from bird to bird and birds grown on wire do not get this disease. In deep litter houses where the stocking density is high the chances to get this disease is high because of heavy contaminations.

SYMPTOMS: Generally weakness, paleness, ruffled feathers, unthriftiness, bloody droppings appear. Affected birds sit around and have little interest in feed or water. High mortality occurs, as disease advances.

LESIONS: Lesions are confined to the intestine and caeca, varying to different species. In the case of Eimeria tenella infection there will be bloody caecal contents. In case of E. necatrix ballooning of intestine with foetid odour. The affected bird will show entertis and speckled apperance of outside wall of the intestine. (Red, white or Red and white).

DIAGNOSIS: Presence of oocysts in faecal samples, symptoms and lesions.

TREATMENT: All sulpha drugs are active against coccidia but toxicity of the drug varies. Sulphaquinoxaline is the oldest (1948) yet a consistently reliable drug for treating coccidiosis outbreaks. This is quite toxic in high and/or prolonged dosages but effective against all species of coccidia. Sulphadimethoxine if effective, safe, and now the drug of choice for treating outbreaks. Other sulpha drugs are also effective but less cosistently than the above two. Liquid Amprol used according to the manufacturer's recommendation is effective against coccidia. There are about 15 or more coccidiostats that could be added in the feed; commercially available for broilers and pullets for caged layers.

PREVENTION: Good sanitation and standard litter management without having wet spots. Replacement of damp litter will help a lot. Treat outbreaks to stop mortality and provide nursing during outbreak.

CONTROL:

(a) For immunity development in pullets and breeder replacements:-

1. Use no coccidiostat, treat outbreaks. OR
2. Use coccidiostat from day old to 10-14 wks of age and discontinue but treating outbreaks. OR
3. Innoculate day old chicks with sporulated oocysts, use high levels of Vitamin A and K to 5 wks of age and treat severe outbreaks. OR
4. Use attenuated vaccines if available.

(b) In broilers and pullets for caged layers:

1. Use continuous low level feeding of a coccidiostat.

Most of the broiler industry is practising a shuttle programme of medication; a system whereby 2 or more different anticoccidials are used in each phase of the broiler growing period. The shuttle programme calls for a different anticoccidial drugs for each of the feed type used. An example is to use monenzine in the starter, clopidol in the grower and Amprollium in the finisher siage. A variety of anticoccidial drug combination is being used commercially.

SOME CAUSES OF COCCIDIOSIS OUTBREAK:

1. Coccidiostat used is not highly effective against the offending species and development of resistance.
2. Uneven distribution of coccidiostat in the feed-(improper mixing).
3. Reduced feed intake for any reason and the birds not taking the expected dose of coccidiostat.
4. Management errors like insufficient feeder and waterer space, feeders too high, poor litter management etc.

(4) WORM INFESTATIONS:

The round worm called Ascarida galli is the most common worm parasite of the chicken and causes heavy economic losses.

Migration of this worm in the intestinal lining causes heammoragic enteritis. Thus the bird is unable to digest and assimilate food properly while loosing blood. The growth and performances are reduced. These worms lay eggs and pass out in the faeces to reach the larval stage in the litter. Viable worm eggs in the litter become infective within five days and hatch again after ingestion in the stomach of the birds. Young chicken are most suceptible to worm damage. By 2 or 3 months of age the chicken develop resistance to this worm. A few worms about ten per hen are detrimental. This problem can be controlled easily in birds reared on wire if there are no flies to act as carriers of the eggs. Thus this is a litter-borne parasite for which control is best done by preventive medications and good management.

SYMPTOMS: General signs include droopiness, emaciation and diarrhoea and drop in production. Death may occur especially in younger birds when the worms block the intestine. On postmortum worms are easily seen in the intestine.

TREATMENT: Piperazine is the most common wormer for this round worm. It works by expelling the worm from the lumen of the intestine and the worm soon die. After outbreaks, Vitamin A fortification of the feed for 5-7 days will speed recovery from damage done by worm migration in the intestine.

PREVENTION AND CONTROL: As these worms are litter borne, parasite control is best accomplished by cordinating medication with management. Broilers reared in new litter in sanitised buildings will be protected. Alw.ys the medication should be timed to eliminate the worms before they reach maturity at 35 days, thus interrupting the life cycle of the parasite. In replacement floor raised pullets the flock should be dewormed at 5 wks of age and then at 30 days intervals up to 21 wks.

In addition to the round worms in the intestine there are worms in caecum (H. gallinae/caecal worm), in the trachea (S. trachea) and cappillary worms (capillaria) in the crop, oesophagus, small intestine and caecum. Tape worms and sometimes gizzard worms are cases in poultry which are of little interest.

When these become a problem, consult a Veterinarian for specific treatment.

(5) AVIAN LEUCOSIS COMPLEX:

(Visceral leucosis/Big liver disease/Marek's disease)

Avian leucosis is a group of cancer like contagious diseases of fowl caused by unrelated families of viruses. This is characterized by the formation of tumours by cells of blood origin:

In this complex two types of diseases can be differentiated such as :

(a) Lymphoid leucosis (L. L)

(b) Marek's disease (M. D)

(a) Lymphoid Leucosis :

It is a caused by a closely related group of RNA containing viruses most of which are capable of producing more than one type of neoplasms. L. L. viruses. are sensitive and easily killed by germicides, die at room temeratures, but survive for long period in storage-freezer temperatures. Incubation period may be as short as 3 - 4 wks.

Young birds are more susceptible and female chickens are more susceptible to all forms of L. L. except osteopetrosis, to which (osteopetrosis) cockerals are more susceptible. This disease spreads from hen to chick via the egg, by direct contact and by contaminated environment. This is not airborne.

SYMPTOMS: Sypmtoms are not seen until birds are about 16 wks or older. Production stops with progressive weakness, paleness, enlarged abdomen, emaciation and death. Greenish diarrhoea is seen in terminal stages.

LESIONS: Tumours of proliferative focal and infiltrative (diffuse) types are seen with emaciation and death.

DIAGNOSIS: Tumours of liver, spleen kidney, proventriculus, pancreas, bone marrow, bursa of fabricius and thymus. Blood smears show small lymphocytes of uniform size.

L. L. must be differentiated from Marek's disease, pullorum, fatty liver degeneration, tumours etc.

TREATMENT: None.

PREVENTION: Eradicate L. L. from breeders.

(b) Marek's Disease (M. D.):

The agent is a DNA cell associated, type B Herpes virus. This virus survives in room temperatures for short periods. It is killed by freezing and by some disinfectants (resist quartenary ammonium compounds and phenols). This stimulate some antibody formation. The incubation period can be as short as 14 days. Birds vary in susceptibility, decreasing with age and females are more susceptible than males. Stress from other diseases increase severity. This is primarily found in chicken prior to sexual maturity (2 - 16 wks old). In mature flocks acute outbreaks are followed by chronic continuation of the disease.

This is transmitted primarily by air within poultry houses. Infected birds carry virus in blood for long periods and become a source of infection to susceptible birds through droppings and saliva Transmission by eggs is of no significance.

SYMPTOMS: Lameness, droopy wings, incordination, paleness, weakness, laboured breathing, enlarged feather follicles (skin tumours) and grey iris with irregular shaped and constricted pupils.

LESIONS: Tumour in nerves, brain, spinal cord, liver, spleen, gonads, kidney, heart, lungs, GI tract, mesentery and occasionally in pancreas, eye, muscle, skin etc Tumours are comprised of pleomorphic lymphocytes (both large and small).

DIAGNOSIS: Affected birds are of 2 - 16 wks of age and by symptoms, lesions and history.

TREATMENT: None.

PREVENTION: Isolation, strict sanitation, excellent husbandary, elimination of stress, control of other diseases, adequate ventilation and incineration of dead birds.

CONTROL: (1) By vaccination at day old; vaccinated birds may become M. D. infected, donot develop tumo-

urs. Attenuated Herpes virus turkey (HVT) commonly used.

(2) By Genetic selection. Obtain M. D. resistance chicks.

(3) Have filtered air positive-pressure ventilation.

(6) AVIAN ENCEPHALOMYELITS: (A. E.) (Epidemic tremor)

This is also a viral (picorna virus) infection of chicken, characterized by incordination and tremors, especially of the head and neck, in chicks & by a production slump in hens. This disease primarily affects young chickens of 1-6 wks of age (usually 12-21 days) and susceptible chicken more than 8 wks old will develop antibodies to A. E. but donot show clinical symptoms at the time of infection.

Transmitted by egg-passage and by direct and indirect spread. Recovered birds are immune and donot spread the virus. Most chicks are exposed in the hatchery at one day of age. Average incubation period is about 10-17 days.

The symptoms appear as tremors of the head and neck. Tremors are best seen after vigorously shaking the birds. Also prog essive incordination and finally paralysis or prostration will be seen.

No treatment for acute outbreaks. Affected birds should be removed, killed and incinerated.

Prevention is by vaccination at 10-16 wks of age for replacement layer and breeder pullets via drinking water. Select hatching eggs from immune breeder flocks. After vaccination and/or natural outbreak the immunity is lifelong.

(7) GUMBORO DISEASE OR INFECTIOUS BURSAL DISEASE (IBD):

This is an acute viral (reo virus), contagious disease of young chicken characterized by mild respiratory symptoms, white watery droppings, severe depression and death. Chicks are more

susceptible up to 12 wks of age. Usually infected at one day with clinical disease occuring at 2½ - 5 wks of age. IBD is endemic in poultry areas, especially broiler areas with populations of young chicken. This is of considerable economic concern because of its crippling effect in recovered chicken. Losses from IBD alone is relatively low but losses from secondary effects due to lowered immunity (protection) are often devastating. Diseases often diagnosed in IBD - infected flocks are paratyphoid, colibacillosis coccidiosis and inclusion - body hepatitis.

This is transmitted from bird to bird or by contact with contaminated environment. This is probably spread by air within the house or by rodents, dead birds and any other residual virus source.

Infected birds show drop in feed and water consumption. Mucoid diarrhoea with soiling of the vent feathers may appear. Chicks are listless sit in hunched position, pick at own vent and sleep with beak resting on floor. Feathers are ruffled and mortality up to 15% in complicated outbreaks may occur but morbidity is 100%.

The lesions are swollen bursa of fabricius with fluid to about 3 times the normal size. Bursa becoming yellowish, or haemorrhagic and at acute stage bursal striations and blood poisoning occur. A few days later the bursa decreases in size markedly like a spindle. This regression is concurrent with clinical recovery. A ricket like condition (soft bones) is common in IBD infected flocks. Treatment is non specific; use antbiotics, vitamins and minerals. Prevention is by vaccination and good hyginine.

(8) PULLORUM DISEASE (Bacillary white diarhoea, BWD):

This is an acute or chornic infectious disease of young poultry caused by a bacterium called Salmonella pullorum. characterized by white diarrhoea and pin point areas of necrosis (dead tissue) in various organs. This organism is highly host adapted and resistant to cold, sunlight and disinfectants. Incubation period for the disease is 4 - 5 days. But the bacterium can live up to 1 year in a chicken house.

This is highly fatal to chicks under 14 days of age and older chicken have greater resistance. Recovered birds remain carriers and shed the organism for life.

This is transmitted primarily via egg from hen to chick, and spreads from infected incubators, hatchers, chick boxes, contaminated houses and epuipments, and carrier birds. The symptoms will be seen when mortality begins at 5-7 days of age and peaks in another 4-5 days. The birds will show depression, huddling, droopiness, chilling, diarrhoea, weakness, pasted vent, gasping and chalk white faeces, sometimes stained with green bile. The disease becomes chronic and survivors become asymptomatic carrriers with localised infection of the ovary.

The postmortum lesions in chicks include pinpoint necrosis of the heart, liver lungs and other organs. In adults common lesions are regression of the ovary, greenish misshapen ova, pericarditis, shrunken testicles or focal necrosis of the liver. These lesions may be in-distinguishable from those of fowl typhoid (S. gallinarum) in adult birds.

DIAGNOSIS: Diagnosis is by history, symptoms, lesions and laboratory serology.

TREATMENT: Antibiotics and antibacterials are effective in reducing mortality. Eg Sulphanamides, Nitrofurans and Spectinomycine (injecton).

ERADICATION: Requires elimination of reactor birds, and in some cases entire flock, followed by decontamination of premises and restocking with pullorum free birds.

(9) FOWL TYPHOID:

This is an infectious blood poisoning disease caused by Salmonella gallinarum characterized by an acute and chronic phase, enlargement of the spleen, "mahogany-coloured" liver and diarrhoea with pasting around the vent. Incubation period varies; but normally 4-5 days and acute phase or outbreak last 5-6 days while the chronic phase lasts for several weeks. This organism is sensitive to sunlight and disinfectants but is very resistant when in the soil, Chickens especially young adults (12 wks or more of age) are susceptible.

Transmission is same as in pullorum while mechanical spread via faeces is more cmmon than with pullorum.

SYMPTOMS: Will be unthriftiness, droopiness, ruffled feathers, loss of appetite, increased thirst and yellow green diarrhoea. The symptoms may be indistinguishable from pullorum and agent susceptiblity is also same.

LESIONS: May be enlarged "mahogany - coloured" liver (metalic sheen), enlarged spleen, distended gall bladder, pin point necrosis in liver and other organs, regression and discoloration of ova etc.

TREATMENT AND PREVENTION: Are the same as for pullorum.

(10) PARATYPHOID (Salmonellosis) :

This is an acute febrile blood poisioning disease of chicks and a chronic intestinal disease of all birds of all ages caused by several Salmonella serotypes. S. typhimurium alone accounts for one half of these out breaks in domestic poultry. This is characterized by diarrhoea and focal necrosis of various organs.

TRANSMISSION: Transmission of this disease is not transovarian but by contamination. Acute outbreaks occur in young birds 7 - 21 days of age with peak mortality at 7 - 10 days of age.

SYMPTOMS: Symptoms are similar to pullorum. Here th liver may be seen swollen, pale yellow and mottled, retained yolk sac, enteritis, necrotic foci on organs, congestion of blood vessels are also seen. Adult birds may exhibit enteritis and diarrhoea only.

TREATMENT AND PREVENTION: Treatment and prevention are more or less same as for other salmonella diseases.

(11) FOWL CHOLERA (Avian Pasteurellosis / FC):

This is also an acute infectious disease affecting most types of fowl caused by a bacterium called Paseuralla multocida and characterized by high morbidity and mortality with extensive haemorrhagic and other septicaemic changes. The causativa

organism can survive for several months in soil and litter but is easily killed by disinfectants, drying and direct sunlight. This usually strikes birds over 6 wks old and recovered birds remain carriers.

This disease may be transmitted by infected birds, free-flying birds, infected premises, rodents, infective dro ppings, nasal secretions and other contaminated materials.

In acute or explosive outbreaks, hens may die in the nest. Some birds may show symptoms of greenish yellow diarrhoea, increased water consumption, birds loose weight, become lame and develop rattling noises from exudates in air passages. Heads of dead birds will be bluish purple (cyanotic).

The lesions vary from bird to bird but usually acute septicaemia, tissue haemorrhage especially in the fat, heart and mucous membranes. Liver in swollon, dark and congested. Focal necrosis of the liver is common.

TREATMENT: Antibiotics like Sulphonamides, Streptromycin injection, can be tried.

CONTROL: Control is best accomplished by prevention with emphasis on sanitation, rodent-predator control etc. Vaccination is advisable for replacement birds. FC vaccinations with bacterims requires a series of two shots given at 2-4 wks interval. Vaccination can be adminstered to birds of any age but preferrabiy from 10-16 wks (S/C on the neck). Donot vaccinate for FC unless it is a problem in the farm.

(2) OMPHALITIS (Naval ill):

This is a disease associated with the inflamation of the navel involving the improper closure of the navel with subsequent bacterial infection. This is non contagious and associated with excessive humidity and marked contamination of the incubator. Bacteria. like E. colli, Pseudomonas, Salmonella. Proteus are often recovered. The chicks will be seen weak, huddling with enlarged abdomen, moist inflammed navel and pasted vents. High mortality occurs for first 4-5 days. The lesions seen will be large unabsorbed yolksac (usually absorbed by 72 hrs), peritonitis, swelling of skin of ventral body area.

There is no good treatment other than control which is by prevention at the hatchery. Good management and sanitation in the brooders is also important. Chilling or overheating of day old chicks greatly aggravates.

(13) DEFICIENCY DISEASES:

Nutritional deficiencies shouid be avoided carefully in commercial poultry production by well balanced feed and supplementation in water. In many deficiency diseases there will be common general signs such as weakness, retarded growth, poor feathering, lameness etc. Thus it is not always possible to recognize the cause from the signs, by ordinary poultrymen. In these circumstances it is always better to assess the diet and/or to consult a Veterinarian for accurate diagnosis and treatment.

Given below (inbrief) are some of the common deficiency diseases and their remedies:

1. Calcium and phosphorous dificiencies along with Vitamin D_3 will show RICKETS and OSTEMALACIA. This can be prevented by balancing calcium, phosphorous and Vftamin D in the feed.

2. PEROSIS (Slipped tendon - hocks) is a deforming leg weakness of young poultry caused by deficiency of the mineral Managanese, and Choline, Niacin and biotin have a role too.

3· With a diet deficient in Zinc, growth is retarded and feather development is poor, while Selenium deficiency may show early signs of ruffled feather.

4. Vitamin A deficiency may bring lesions resembling pustules in the mouth., pharnyx and esophagus. In general there is keratinization of the epithelium and respiratory Infections are more possible in these birds.

5. POLY NEURITIS or Vitamin B_1 deficiency reduces appetite and non reversible lameness and muscle paralysis because of nerve degeneration. Check Thiamine (B_1) level in the feed and also the level of Amprol, which should not be in excess.

6. "CRAZY CHICK DISEASE" or ENCEPHALOMALACIA is caused by Vitamin E deficency where staggering, stumbling,

and paralysis will be seen. Check level of Vitamin E and any other factors like addition of antioxidants which prevent loss of added Vit E in the feed.

7. A reduction in the prothrombin content of the blood is associated with Vitamin K deficiency. Supplementation of Vit K is necessary when there is coccidiosis and other intestinal parasitic diseases which increase the need for this Vitamin, because of bleeding.

8. There are several other deficiency diseases in poultry and they must be consulted by expert Veterinarians and treated accordingly.

(14) EXTERNAL PARASITES OF POULTRY:

Lice, Miters, Ticks etc are some of the common ectoparasites found in poultry. These are host specific and are often associated with wild birds. Otherwise infestations occur when birds and equipments from infested area, are brought in to the farm. Parasites spread throughout the flock by contact and by their own migration via nest and litter. Cats, rodents and even poultrymen may help the spread of parasites. Strict sanitiary measures will often prevent pest populations from building up. Lice and mites can lower production and interfere with growth and vitality by making the birds restless. When hot weather comes in check your farm for mites as they can multiply rapidly in this weather and become a serious problem overnight.

Treatment should consist of a thorough cleaning of the house in conjunction with recommended insecticide applications. Materials can be applied as paints, sprays, dusts or dips. Dust can be applied with a shaker can. If dusting birds individually, shake dust into feathers of each bird until the dust reaches the skin.

Use a plunger or rottary type hand duster when treating the whole flock. The roost, walls, litter and equipment can be treated by painting them with insecticides or spraying or dusting. Painting solutions are prepared by mixing insecticides with kerosene, diesel oil, or water. Pay special attention to cracks, crevices, and rough spots where ticks and mites can

hide. Donot contaminate feed or water. Repeat treatments if necessary. Always consult a Veterinarian before using insecticides, as these are poisionous substances and correct dilutions/ mixes are essential.

Drugs Used: (1) Benzene Hexa Choloride (BHC)
(2) D. D. T.
(3) Malathion etc.

(15) OTHER REPIRATORY DISEASES:

Poultry donot have "colds" but respiratory ailments of the air passages, lungs and airsacs and are caused by specific disease agents. The diseases can be listed as follows:-

(a) **Viral diseases:** Such as NCD / Ranikhet, Fowl Pox (wet form), Infectious bronchitis, Infectious laryngo tracheitis, Avian influenza inffections, etc.

(b) **Virus Like Organisms (Diseases) :** Mycoplasmosis (pplo)-gallisepticum and Synoviae, Ornithosis.

(c) **Bacterial diseases:** Infectious coryza, Roupe (pasterulla spp)

(d) **Fungal diseases:** Aspergillosis.

Diseases like NCD, Fowl Pox, Mycoplasmosis, and Aspergillosis are worthy to be described here. NCD/Ranikhet and Fowlpox are already mentioned before and a brief note on Mycoplasma gallisepticum, M. Synoviae and Aspergillosis, follows to complete the important Respiratory diseases of our concern.

(A) CHRONIC RESPIRATORY DISEASE (Mycoplasma Gallisepticum) CRD/MG:-

This is a contagious disease of poultry of all ages characterized by air sacculitis with yellow caseous (cheesy) exudates. The causative organism is Mycoplasma gallisepticum which is very small and doesnot have a rigid cellwall. This is sensitive to several antibiotics and is easily destroyed by sanitizers, disinfectants and sunlight.

Younger birds are more susceptible to the infection than the older mature birds. Normally this infection gets compli-

cated with other secondary bacterial infections such as E. coli, proteus etc. When it is uncomplicated chickens tolerate this infection better than turkeys. After infection, antibodies are produced and this gives some protection. The presence of antibodies to MG is interpreted as evidence of flock infection, except in controlled exposure programmes. MG positive birds are shedders of the organisms.

This is transmitted by transovarian passage from infected breeders via the egg. MG can spread within the poultry house by direct bird-to-bird contact and by exhaled respiratory droplets. MG can also spread by careless visitors or by the use of contaminated equipments or vehicles.

SYMTOMS: Chicken may not show outward symptoms when infection is uncomplicated, Sticky, serous exudates from nostrils, foamy exudate in the eyes and swollen periorbital sinuses with respiratory rales, sneezing and flipping of the head may be seen. Affected birds are often stunted and unthrifty.

LESIONS (P.M): Muco-caseous exudates in the nasal passage, trachea, lungs, and airsacs; will be seen and diagnostic, if exudate is bright yellow and cheesy. Membranes of the airsac will be thickened and cloudy with caseous exudates.

DIAGNOSIS: History, Symptoms, lesions, Serology and Isolation of organism.

TREATMENT: Tylosin, Spectinomycin and Lincomycin, Doxy cycline etc. are active when given via feed, water or injections.

PREVENTION: Eradication is the best control of mycoplasma diseases.

(1) Maintain mycoplasma-free breeders and establish a mycoplasma monitoring programme and dispose infected flocks.

(2) Practice strict isolation and obtain immune birds.

(3) Carry out the Tylosin broiler programme at day old and at 4 wks in drinking water.

(4) Expose layer replacement and obtain immune birds.

(5) Hatching eggs could be treated by antibiotic dips, heat treating or a combination of these.

(B) INFECTIOUS SYNOVITIS (Mycoplasma synoviae):

This is again another infectious disease caused by Mycoplasma synoviae characterized originally as an infection of the joints and recently as respiratory disease. Birds of all ages can be infected but the synovitis manifestation is of fore most concern in chicks. Transmission is same as like that of Mycoplasma gallisepticum.

LESIONS: Synovitis form: Swelling and infection of the joints especially on the hocks, wings and feet. Internally dehydration, enalarged liver and spleen and stringy exudates around heart are seen. Chronically infected birds become emaciated, dehydrated and develop a greenish diarrhoea.

Respiratory form: "Silent air sac" that may not be detected by growers. The airsacs may be filled with cheesy-liquid exudates resulting in heavy condemnation at processing.

DIAGNOSIS, TREATMENT AND PREVENTION are similar to that for Mycoplasma gallisepticum.

(C) ASPERGILLOSIS: (Brooder Pneumonia)

This is an infectious disease of birds caused by a fungus called Aspergillous fumigatus, characterized by respiratory distress and caseous plagues in the lungs and airsacs. This occurs as an acute disease of young birds with high morbidity and mortality. It is a chronic disease with low morbidity in mature birds. This is transmitted by air in the form spores in the hatchers, brooder houses, litter or feed.

The symptoms in acute form will be gasping, sleepiness, loss of appetite, and occasionaly paralysis or convulsions. Chronic forms will show emaciation and gasping. NO TREATMENT for individually infected birds. But control by raising the humidity of the environment, eliminating the source of infection and medicating with a funghistat. Eg. Mycostation, Gention violet, Sodium or Calcium propionate in the feed and/or Copper Sulphate 1:2000 in the water for 3 - 5 days.

CHAPTER IX

INCUBATION AND HATCHING OF EGGS

The process of hatching by which in the space of 21 days a microscopic germ is changed into a downy chick capable of walking, eating, and expressing its needs seems magical. For such rapid development and change within the egg, great care must be exercised to provide correct conditions if a good percentage of strong chicks are to be hatched.

INCUBATION PROCESS:

The optimum incubation temperature is 100° F, when the relative humidity is 60% the concentration of oxygen is 21%, the carbondioxide is O. 5% and the air velocity past the eggs is approximately 12 cm/mt (5 inch/mt).

For very successful hatch the temperature should be 100° F (for still air 102°) and the humidity at about 60% during 1st 18 days and slightly higher at about 70% for the last 3 days.

DEVELOPMENT OF THE EMBRYO (Briefly)

Day 1:- Spinal cord, alimentary tract start to develop. Head, nervous system and eye originates.

Day 2:- Heart, blood vessels, ear begins to develop. This is a very vulnerable period for the embryo.

Day 3:- Nose, legs, wings begin to develop and the embryo rotates to be on the left side. The circulatory system rapidly increases.

Day 4:- Tongue begins to develop and the circulatory system is very evident even to the naked eye.

Day 5:- Reproductive organs appear and differentiate sex.

Day 6:- Beak begins to take normal form and some voluntary movement of the embryo is notable.

Day 7:- Body begins to develop rapidly and become visible.

Day 8:- Feather germs appear.

Day 10:- Beak hardens, toes and scales start appearing.

Day 11:- Walls of abdomen appear and intestine seen in yolk sac.

Day 12;- Chick down is present and skeleton begins to calcify.

Day 14:- Embryo rotates to parallel to long axis with head towards the large end.

Day 17:- The head turns so that the besak is under the right wing.

Day 19:- The yolk sac begins to enter the bodycavity and chick finds a position to pip the shell.

Day 20:- Yolk sac completely enters in and the chick occupies the full area except the air cell. Pulmonary respiration begins and may start to pip the shell.

Day 21:- After first piping – chick rests for several hours and then cuts a circular line in a counter clock wise direction. It takes about 10 – 20 hrs from the first piping to full liberation out.

HATCHERY

A hatchery building should atleast have six rooms for various activities such as:-

(1) A room to hold hatching eggs at one end.

(2) Next, a room for grading and traying eggs.

(3) Then, the room for incubation (Incubators).

(4) Adjoining, the room for hatching (Hatchers).

(5) Then, the room for chick storage.

(6) And adjoining this, will be the room for grading and sale of chicks.

The fumigation room should be as small as possible with the refrigeration room temperature being at 65° F (18° C)

The ventilation can be by forced draft ventilation with the following approximate necessities:-

VENTILATION Per 1000 Eggs

Out side Temperature	Egg holding tempe-rature	Incubation room	Hatching room	Chick hol-ding room 1000 chicks
1. 100° F (37.8° C)	2 Cu. ft/or 0.06 m^3	12 Cu. ft/ 0.34m^3	25 Cu. ft/ 0.71 m^3	30 Cu. ft/ 0.83m^3
2. 70° F (21.1° C)	2 Cu. ft/ 0.06 m^3	10 Cu. ft/ 0.28m^3	20 Cu. ft/ 0.57 m^3	25 Cu. ft/ 0.71m.^{3}

HUMIDITY IN THE HATCHERY

1. Egg holding room - 75 - 80%
2. Incubator and Hatcher room - 50%
3. Chick holding room - 60%

When the air from the incubating room (say 70° F at RH 75%) is taken into the incubator (100° F) the relative humidity will drop to 30% which is lower than the required and expected (50 - 60%). This is why additional humidity must be supplied in the incubators even though the room has adequate RH.

EQUIPMENTS NEEDED FOR INCUBATION

1. Floor space for fitting.
2. Forced draft circulation.
3. Automatic air temperature controls.
4. Completely automatic Humidifiers.
5. Carbon dioxide recorders.
6. Mechanical egg turners.

7. Seperate hatchers.
8. Efficient coolers.
9. Down collectors.
10. Emergency system with alarm lights and bell for break down signals.

OTHER EQUIPMENTS NEEDED

1. Egg candlers.
2. Test Thermometers.
3. Service Tables.
4. Chick box racks.
5. Chick graders.
6. Sexing Equipments.
7. Vaccum floor cleaners.
8. Presure pumps.
9. Tray washers.
10. Room Air circulators.
11. Debeaking Equipment.
12. Automatic syringes for vaccinations.
13. Marek's disease vaccinating equipments.
14. Mycoplasma test equipment.
15. Refuse disposals system etc.

FACTORS NEEDED FOR MAINTAINING HATCHING EGG QUALITY

1. Provide good nesting material.
2. Prevent floor eggs.
3. Collect hatching eggs 4 - 5 times a day.
4. Close the nest in the night.
5. Cool eggs gradually and not suddenly.
6. Donot pile eggs in baskets or heaps, use trays.

WHILE TRANSPORTING HATCHING EGGS:

1. Transport in flat egg cases, with extra care.
2. Resanitize eggs at the entrance of the hatchery.
3. Temperature of the truck transporting should be at 65° F (18° C) and RH 75 - 80%.

SELECTION OF HATCHING EGGS.

1. Give importance to size and weight. Exclude very small and very large ones.
2. Closer to ovoid shape will hatch best.
3. Darker shades of shell is better.
4. Porous, thin shell quality should be selected as flaky or chalky shells donot hatch well.

HANDLING HATCHING EGGS:

1. The threshold embryonic temperature is about 75° F (20° C) and above which embryonic growth will start. The optimum temperature in the incubator (forced draft) should be 99° F (37.5° C). If the temperature goes above or falls down the embryo will grow weaker and the hatchablity decreases.

2. To curtail embryonic development the egg should be cooled gradually and kept in the egg holding room at 65° F (18.3° C) at a RH of 75 - 80%.

3. The holding time for hatching eggs should be not more than 4 - 5 days for good hatch. As a thumb rule hatching time is delayed by 30 mts and hatchablity reduced by 4% for each additional day the eggs are held or stored for more than the prescribed 4 days.

4. The eggs should be held with the small end upwards in the storing room but incubated with the large end upwards.

5. Clean eggs need not be washed. Incorrect washing can be very adverse. Use sprays by machines. Washing water must be clean and free of iron. The wash solution must be warmer than the interior of the egg as water will be drawn in. It is better to have wash temperature at about 43 - 50° C. Quartenary ammonium compounds or hypochlorites may be used for egg washing (at about 250 ppm for quartelnery ammonium compounds).

MANAGEMEMT OF INCUBATORS DURING INCUBATION

1. Levelling of the incubator should be done according to the manufacturer, as wrong levelling can affect temperature regulation and distribution.
2. Sanitation and fumigation should be carried out efficiently every time before setting the eggs.
3. Regulate the incubator with a trial run and check, to study it.
4. Check for sufficient ventilation as carbondioxide percentage of the inside increases above 2%, the hatchability drops rapidly. On the 21st day about 150 times of air may be required, compared to the first few days during incubation.
5. Turning of eggs should be operated well that during early days of incubation starting from the 3rd day, the number of turnings should be 4 - 6 times daily and after about a week it could be regulated at 8 hrs equal intervals (4 times/day). Cease turning after 18th day. The object of turning the eggs is to prevent the embryo sticking to the shell membrane.
6. Testing of eggs (candling) should be carried out on the 7th day and 14th day to discard.
7. On the 19th day the nursery tray should be placed or transferred to the hatcher.

A good hatch is that when the chicks are out of their shells before the end of 21st day. It is of no use to assist a chick to come out of its shell as these chicks will be weak or crippled. The chicks which have hatched should remain in the hatcher without any feed for atleast 18 - 24 hrs. After drying off and fluffed out, the temperature could be gradually reduced to 93-95° F for "hardening off" the chicks before transferring them to the brooder.

CAUSES FOR POOR HATCHES:

1. Standard of the machine is poor.
2. Age of eggs is more than 6 days.

3. Turning of eggs not done properly.
4. Fertility of the eggs being low.
5. Poor moisture controlls (RH)
6. Ventilation irregularities.
7. Lower or higher temperatures due to faulty thermostats or wrong manipulations.
8. Dead in shells can be due to one or more combined factors such as temperature, humidity, ventilation, Incorrect turning, parent stock nutrition etc.

EFFECTS OF INCUBATION TEMPERATURE

OBSERVATION	CAUSES
1. Large number of dead embryos on the 18th day.	1. High temperature was present at any time during incubation.
2. Sticky chicks or chicks dead after pipping the shell	2. High temperature at hatching time.
3. A reduction in the length of incubation period with a lower % of hatch.	3. High temp. through out the incubation period.
4. Large number of unpipped eggs with fully formed embryo or a large number of pipped eggs from which fail to emerge out.	4. Low temperature was present.

EFFECTS OF HUMIDITY IN HATCHING & PROBABLE CAUSES

OBSERVATION	CAUSES
1. Increase in length of incubation or fully developed dead embryos with beak in air cell.	High humidity during setting period.
2. Chicks dead after pipping the shell or sticky chicks with pieces of shell adhering to the chick.	Low humidity with high temperature at hatching time.

3. Chicks with unabsorbed yolk and unhealed navel or sticky chicks with albumen sticking down.	High humidity with high temperature at hatching time.
4. Large No. of pipped eggs from which chicks fail to emerge.	Low humidity during incubation or hatching.
5. Under sized chicks with poor bone development.	Low humidity during incubation.

TABLE FOR FINDING RELATIVE HUMIDITY

Dry bulb Temp (° F)	Wet bulb reading			Still Air Incubators		
100	81.3	83.3	85.3	87.3	89.0	90.7
101	82.3	84.2	86.2	88.2	90.0	91.7
102	83.0	85.0	87.0	89.0	91.0	92.7
RELATIVE HUMIDITY	45%	50%	55%	60%	65%	70%

IMPORTANCE OF VENTILATION IN HATCHING

1. Ventilation care is more important in large incubators than small.
2. Ventilation is important in any incubator especially at hatching time.
3. Ventilation could be used to reduce temperature or humidity when these two are not normal.
4. Ventilation depends according to the incubator room.
5. If ventilation is poor, chicks will pant at normal temperature inside the hatcher because of increased accumulation of carbon dioxide.

HATCHERY SANITATION

The hatchery section in poultry pruodction requires more attention to sanitation than any other sections. For efficient sanitation the following primary factors are important to note:-

1. Locate hatcheries in dust free areas far away from farms and other possible contaminating sources.
2. Design hatchery to permit one way flow of traffic from egg room to incubators to hatchers to chick holding area.
3. Deliver chicks within 24 hrs.
4. Donot recirculate air but design in such a way that fresh air enters.
5. Construct the walls, ceilings and floors with water repellent materials. Give care to good floor drainage.
6. Clean and sanitize after each hatch.
   (a) Efficient emptying of refuse,
   (b) Soak trays and egg racks in detergent to remove debris.
   (c) Wash in water with detergent.
   (d) Sweep, vaccum, or hose, chick down from hatchers.
   (e) After cleaning movable equipments sanitize with Quarternary ammonium compounds or hypochlorites.
   (f) After cleaning incubators and hatchers disinfect using disinfectants.
7. Require that all personnel wear clean, washed clothing or uniform with appropriate personal hygine.
8. Control visitors and cross traffic.
9. Accept only clean eggs or wash and sanitize or fumigate eggs in egg receiving room before storing in cooler.
10. Insist and practice a breeder flock sanitation.

FUMIGATION OF EGGS

1. Fumigation should be first done soon as possible after collection from the nests.
2. Use formaline and potassium per manganate at the rate of 1.2 ml formalin (37% formaldehyde) with 0.6 gms of pottasium per manganate ($KMNO_4$) for each cubic foot of space in the cabinet.
3. Humidity for this method is not critical but extra humidity may be provided in hot weather.

Hatchery operators should be able to recogginze two important diseases of hatchery origin namely Aspergillosis and Omphalitis. In case of aspergillosis look out for moulds and do a vigorous clean - up and disinfect with formalin fumigation or phenolics.

CHAPTER X

STRESS AND STRESS FACTORS IN POULTRY

"STRESS" Stress include anything that causes the birds in the flock to deviate from the usual rate of growth or level of production. Most stresses originate due to management errors.

The causes can be 3 fold:-

(1) Faulty initial planning - Building, equipments, ventilation, facilities.

(2) Poor flock management - Wet litter. waterers, faulty Temperature, Humidity, Ventilation, Debeaking, Vaccination, Handling, and Disturbances.

(3) Outside elements - Diseases, Parasites etc.

The combination of stress factors takes the bird to the breaking point just like a ball is set to roll once and it continues to roll down and down.

Ofcourse in a flock when things get rough all birds suffer but some more than others and production start to decrease showing culls. In most cases these become irreversible and the whole farm fails.

In most other cases the real problem may not be one or two factors alone to a severe degree but combination of several stress factors and the effects are not just a physical total but often multiplications. (like 1 + 1 = 4 or more).

So it is always better to prevent the stress even if they are mild because very often it is worse to have several mild stresses in a flock than having one big stress.

STRESS FACTORS ARISE FROM:-

(1) Competition or social tension and fighting can start to establish a peck order position. That is why it is found that the birds perform better in small pens (100 - 200) than in large pens. (1000 or more). In smaller pens the birds get to some understanding about the peck order and soon they start to adjust for a smooth life compared to larger pens where several new faces can challenge differently everyday resulting in continuous fights, chase and ultimately stress. Thus smaller units with enough ventilation, cooling, feeding, watering and laying facilities will always perform better, than bigger pens.

(2) Faulty nutrition can also bring in stress. Here the quality of feed is not concerned much but an out of balance feed like too much grain in relation to mash or too much of powdery form. In these circumstances birds will eat for their taste and not for the body maintenance and reserve. Here routine body weight check will help identifying the problem.

(3) Presence of diseases and unsanitary condition can also bring in stress to a flock. Even medications, vaccinations, the process of vaccination debeaking, handling, and disturbing can cause to a degree.

(4) Changes in the environment like natural climate and artificial heating, ventilation or humidity can bring in stress.

(5) Age.

PREVENTION OF STRESS:

(1) Avoid the causes of stress factors.

(2) If unavoidable during climate change, vaccinations and diseases give supportive treatment with antistress substances like, multivitamins, minerals, aminoacids, fortified feed, antibiotics etc.

(3) Efficient breeding - Hybrid Vigor can give resistance to certain stress.

(4) Spend lot of time with your birds, keep on observing and think to know their behaviours and difficulties.

* * * * * * *

FEW MORE HINTS.....

(1) The tolal air breathed at rest by a fowl in a comfort ble environment is about 1.6 cu. ft per bird per hour.

(2) A fasting hen at rest produces about 2.75k. cals per hour per gram body weight, but for a D/O chick it is about 5 . 5 K. cals/hr/gm BW.

(3) The high - lethal body temperature for fowls is about 117° F or 47 . 2° C. This body temperature could be reached if chicks are exposed at 160° F for ten minutes. (The normal body temperature of D/O = 103 . 5° F (39° C). Adult fowl = 105 - 107° F (40 . 6 - 41 . 7° C).

(4) The - low - lethal body temperature for D/O chicks is about 62 F, for two weeks old birds 67° F and at maturity 73° F (22 . 7° C).

(5) New Hampshire chicks are more susceptible to over heating than White Leghorns.

(6) Detect the concentration of ammonia in poultry sheds by the following clues:

(a) Ammonia just smelling..... 10ppm.

(b) Respiratory damage and reduced feed efficiendy ..... 20ppm.

(c) Nasal and eye irritation..... 50ppm.

(7) Feather meal with supplementation of DL-Methionine, Lysine Hcl, L-Tryptophan and L-Histidine Hcl can be used in poultry feed.

(8) Ammonium disinfection for coccidiosis could be done with 20 kg of Ammonium sulphate and 10 kgs of Calcium hydroxide mixed in 100 litres of water for every 100 sq.m of floor area.

(9) The poultry diseases and common ages of occurance Mareks disease- 3 – 6 mths, Lymphoid Leucosis - over 4 mths, Bursal disease (IBD) 3 - 6 wks, pullorum 0 - 3 wks, Fowl Cholera - acute cases below 3 mths and chronic forms may be in adults, Infectious, Synovitis 1 - 2½ mths, Aspergillosis 0 - 1½ mths, Coccidiosis - E: tenella younger birds 2wks onwards, E. necatrix - older birds.

(10) Withdrawal periods for drugs to avoid drug residues. Tetracycline 1day; Sulphaquoxaline 10 days; Sulphadimethoxine in water 5days; Streptomycin in water 4 days, if injections 30days; Furazolidone 5days; Clopidol 5days; Monensin 3days; Tylosin in feed 5days; Tiamutin 3 days Erythromycin 5days Spectinomycin 5days; Nicarbazin 4 days.....according to US - F.D.A.

(11) The following combinations have antagonic actions thus avoid giving together;-

(a) Tiamutin and Monensin or Salinomycin.

(b) Nalidixic acid and Furans.

(c) DOT and Furazolidone.

(12) Thumb Rules

(a) **Air flow:** provide O . O12 cu. ft of air flow/mt/lb. B.W. for each 1° F temp at RH 30 - 60%.

(b) **Openings for air intake**; allow 1 sq. in of intake opening for each 4 cfm of exhaust (when light traps are used for fans allow 1.25 sq. in).

(c) **Placement of light bulbs**:- 1 to 1½ ratio (the distance between the bulbs should be 1½ times the distance from the bulb to the birds level).

The outer edges of the house (inside) should be only 1½ times the distance between the bulbs.

(d) Feed intake for broilers = age in wks/100 birds/day (expressed in kg).

(e) Water intake of broilers is usually twice the age in wks/100 birds/day (expressed in litres).

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CONVERSION CHART

Temperature

$$\frac{F-32}{9}=\frac{C}{5}$$

°C	°F
40	104.0
39	102.2
38	100.4
37	98.6
36	96.8
35	95.0
34	93.2
33	91.4
32	89.6
31	87.8
30	86.0
29	84.2
28	82.4
27	80.6
26	78.8
25	77.0
24	75.2
23	73.4
22	71.6
21	69.8
20	69.0
15	59.0
10	50.0
5	41.0
0	32.0

1 cm = 10 mm = 0.3937 in
1 m = 100 cm = 1.0936 yd
= 3.28 ft
1 km = 100 m = 0621 mile

1 in = 2.54 cm
1 ft = 30.48 cm
1 yd = 0.9144 m
1 mile = 1.609 km

1 g = 0.002205 lb = 0.03553 oz
1 kg = 2.2046
1 ton = 1000 kg = 0.9072 shot tons
= 1.0160 long tons
(USA)

1 oz = 28.35 g
1 lb = 0.4536 kg = 453.5924 g
1 long ton = 1 016 ton = 1 016,05 kg
1 short ton (USA) = 0.9072 ton
= 907.185 kg

1 cm^2 = 0.155 sq in
1 m^2 = 1.196 sq yd
= 10.7639 sq ft

1 sq in = 6 4516 cm^2
1 sq ft = 0.0929 m^2
1 sq yd = 0.8363 m^2

1 litre = 2.22 imp. gal
= 0.2642 US gal
1 pt (Imp.) = 0,5682 litre
2 pt (USA) = 0.4732 litre
1 gal (Imp.) = 4.54596 litre
1 gal (USA) = 3.7853 litre

1 cbm/h = 0.5886 cu ft/min
1 m/sec = 196.85 ft/min
1 kcal = 3.97 BTU
1 kcal/cbm = 0.1123 BTU/cu ft
1 kcal/kg = 1.8 BTU/lb

1 ftc = 25 watt/125 sq ft

POULTRY FARMING

In agriculturally advanced countries, poultry farming is no longer an art or a way of life but a highly scientific and commercial business.

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