HATCHERY MANAGEMENT PRACTICES IN POULTRY

Extension Bulletin No. 86
Poultry Series No. 5

Produced and Distributed By

National Agricultural Extension and Research Liaison Services
Ahmadu Bello University
Zaria.

ACKNOWLEDGEMENT

The poultry industry in Nigeria has been under a crisis situation for the past decade. The reasons for this crisis are numerous, but the major consequences have been the total collapse of many poultry farms. Often the first farms to close down are the hatcheries, because of their more demanding nature. Unfortunately for the poultry industry, the hatchery enterprise is the most critical, for it is the source of day-old chicks.

The purpose of this booklet is to provide basic information needed for both small and big time hatcheries to function effectively. In particular the use of kerosene incubator for small scale rural hatchery is included. Since the principles of hatchery operations are same for all classes of poultry, this booklet will be found useful for hatching of eggs from chickens, ducks, guinea fowls, quails, pigeons etc.

We wish to acknowledge the contributions of our colleagues from the National Animal Production Research Institute (NAPRI), Shika, and the Department of Animal Science, Ahmadu Bello University, Zaria who reviewed the manuscript. Thanks also to our colleagues at NAERLS who contributed in various ways to the publication of this bulletin.

I..I. Dafwang, J.Y. Odiba and E.I. Ikani

Table of Contents

INTRODUCTION

The age-long question: "which came first, the chicken or the egg?" has never been a puzzle to Bible Scholars because we read in Genesis Chapter one that God created the birds first. It was the hens among the birds that laid the first eggs, which hatched into chicks.

Eggs can be hatched in two ways - by natural incubation, which involves setting the eggs under a broody hen, and by artificial incubation, using an incubator. Nature's way of hatching eggs is satisfactory if only a few chicks are desired. For only 25 or 30 chicks, two hens will be needed to hatch and care for them. Obviously, this method is less expensive since it does not require the provision of an incubator. Although a good mother hen is the best incubator and hatcher of her eggs, the use of artificial incubators has been justified on many grounds: broodiness decreases egg production; hatching is seasonal with a hen; one hen can incubate only 15 eggs at a time; the hen requires more space per egg than the artificial incubator; and there is a greater risk of disease transmission from hen to egg under natural incubation. Thus, the poultry industry would never have reached its present level of development without a more rapid means of multiplying the species.

The incubation of eggs artificially has made great progress over the years. Long before the invention of thermometers, Chinese and Egyptian poultry men were hatching eggs artificially. Proper temperatures were maintained through a sense of touch, and the "secrets" involved were kept within families and passed from one generation to the next. The first incubator was built in 1847 in the United States, and practical models were perfected in 1887. It was not until after 1900 that most progressive poultry men accepted artificial incubation. There is no doubt that artificial incubation as carried on with our present-day incubators is thoroughly practical and possesses many advantages over hatching by natural means. Modern incubators are equipped with automatic controls and it is not uncommon to find some that can incubate as many as 100,000 eggs per setter.

A thorough understanding of the fundamentals of incubation and of incubator operation as outlined in this bulletin, coupled with good management, will assist in ensuring satisfactory hatches, to meet the ever increasing demand for day old chicks.

HATCHERY REQUIREMENTS

To operate a hatchery successfully, one requires the following:

Hatchery Buildings

Hatchery buildings are usually designed to provide room for holding hatching eggs prior to setting, grading and traying of the eggs; incubating and hatching machines; chick sexing; grading and holding prior to sale. Additional rooms are often provided to cater for fumigation, washing of equipment and showering of visitors.

The design and construction of a hatchery must be professionally done because of the absolute necessity for room temperature and humidity control and regular washing and sanitation for disease control purposes. The size of the incubators and hatchers plus any anticipated future expansion must be used to determine the size of building. Table 1 gives the guideline on floor space requirements for hatchery rooms. High ceilings of about 3.1m (10 ft) are necessary since most hatcheries are built with force-draft ventilation system. Because the interior of the hatchery has to be subjected to regular washing and disinfection, it is important that the inside walls should be covered with a glazed, hard, non-absorbent finish. Tiles are usually used to accomplish this objective. The floors, which must be concrete should also have a glazed finish in addition to making provisions for adequate drainage. Other construction details to provide for ventilation and refrigeration facilities must also be considered.

It is for the same reason that the hatchery building should be cited

Table 1: Floor space for hatchery rooms.

Room Type	Per 100 eggs Incubator-hatcher (m^2)	Per 1000 straight-run chicks per hatch (m^2)
Egg receiving room	0.19	1.39
Egg storage room	0.03	0.23
Chick holding room	0.37	2.79
Wash room	0.07	0.55
Storage room	0.07	0.49

Source: Mack O. North, 1984. Commercial Chicken Production Manual.

Egg-flow and personnel-flow through the hatchery must be such that there is no back tracking, as shown in fig.1. This is in order to minimize the risk of disease transmission between the eggs and the chicks.

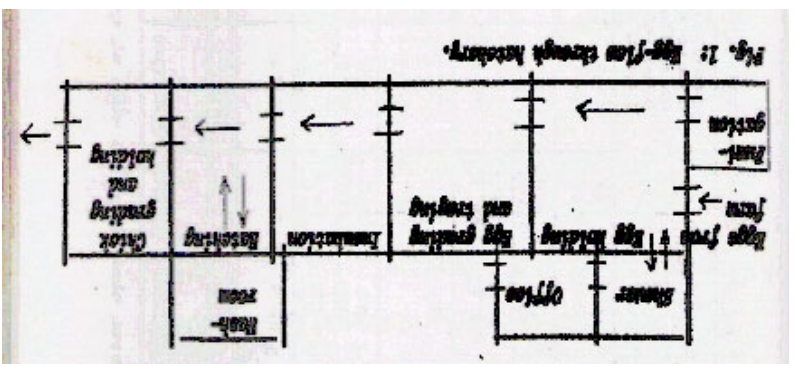

Figure 1: Egg-flow in the hatchery.

about 150m (500ft) away from the nearest poultry house and should have its own entrances/exits separate from those being used for the stock farm. All hatchery personnel should be separated from those working in the breeder farm. The major goals for optimum hatchery building design and construction are: to cut out any contact between eggs and chicks, provide optimum ventilation and refrigeration, provide for maximum sanitation and disease control and the efficient delivery of management practices by hatchery personnel.

Incubators

An incubator is a machine into which fertile eggs are usually set for hatching. Two types are used commercially; the Cabinet (force drought) and the flat (table) or still air type.

Cabinet Incubators: These Incubators are of very large capacities, which can contain very large number of eggs, from about 3,000 to 30,000 and even more. The incubators (fig.2) are highly specialized type of equipment which are electrically heated and operated. They are sold as separate setter and hatcher units. Ventilation is by fans with automatic heat/humidity controls and egg-turning devices during the incubation period, which varies from between 14-37 days depending on the type of poultry birds as shown in Table 2. The eggs are placed on their small ends vertically while the turning is carried out by tilting all the egg trays. Three days before the eggs are due to hatch, the eggs are transferred from the setter into the hatcher. The hatcher also controls the temperature and relative humidity but no turning of eggs. In most cases the trays used for egg setting are different from those for chick hatching.

Table 2: Incubation period and incubator operation for eggs of domestic birds 1,2,3.

Requirements	Chicken and Bantam	Turkey	Duck	Muscovy Duck	Goose	Guinea Fowl	Pheasant	Peafowl	Coturnix Quail	Chukar Partridge	Ostrich	Pigeon
Incubation period (days)	21	28	28	35-37	28-34	28	23-28	28-30	17	23-24	42	17
Forced-air operating temperature (degrees°C. dry bulb)	37.5	34.4	37.5	37.5	37.4	37.5	37.5	37.4	37.5	37.5	37.5	37.5
Humidity (degrees C., wet bulb)	29.4- 30.6	28.3 - 29.4	29.4 - 30.0	29.4-30.0	30.0-31.1	28.3-29.4	30.0-31.1	28.3-29.4	29.5-30.0	26.7-27.8	30.0-31.1	29.4-30.0
Do not turn eggs after	19th day	25th day	25th day	31st day	25th day	25th day	21st day	25th day	15th day	21st day	40th day	15th day
Operating temperature during last 3 days of incubation (degrees C dry bulb)	37.2	37	37	37	37	37.2	37.2	37	37	37	37	37
Humidity during last 3 days of incubation (degrees C. wet bulb)	32,5-34.5	32.5-34.5	32.5-34.5	32.5-34.5	32.5-34.5	32.5-34.5	33.5-35.0	32.5-34.5	32.5-34.5	32.5-34.5	32.5-34.5	32.5-34.5
Open ventilation holes one-fourth	10th day	14th day	12th day	15th day	1st day	14th day	12th day	14th day	8th day	12th day		8th day
Open ventilation holes further if needed to control temperature	18th day	25th day	25th day	30th day	25th day	24th day	20th day	25th day	14th day	20th day		14th day

[1]It has been reported that duck eggs hatch better in still-air incubators than in forced-air incubators.
[2]For still-air incubators add 2-3°F to the recommended operating temperatures.
[3]Better tchability may be obtained if goose eggs are sprinkled with warm water or dipped in lukewarm water for half a minute each day during the last the incubation period.

SOURCE: Incubating eggs of domestic birds. Circular 530; Clemson University, N.C. U.S.A.

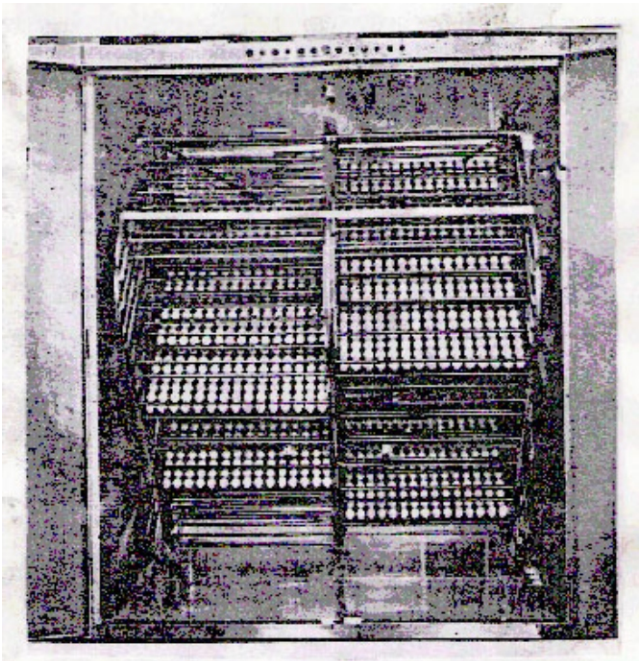

Fig.2: Cabinet Incubator

The Flat (Table) Incubators: The flat type incubators (fig. 3) are usually of small capacities; of between 50-500 eggs with only a single layer incubation on which the eggs are laid horizontally i.e. lying flat. Due to the small capacities of these machines, they are found mainly at research centres. The heating system is either by hot water or hot air supplied by electricity. Although early incubators were oil (kerosene) heated, most of these type of incubators now rely on electricity to heat the air or in some cases, the water of the system. Of recent, the kerosene incubator is being popularized in Nigeria by the National Veterinary Research Institute, Vom.

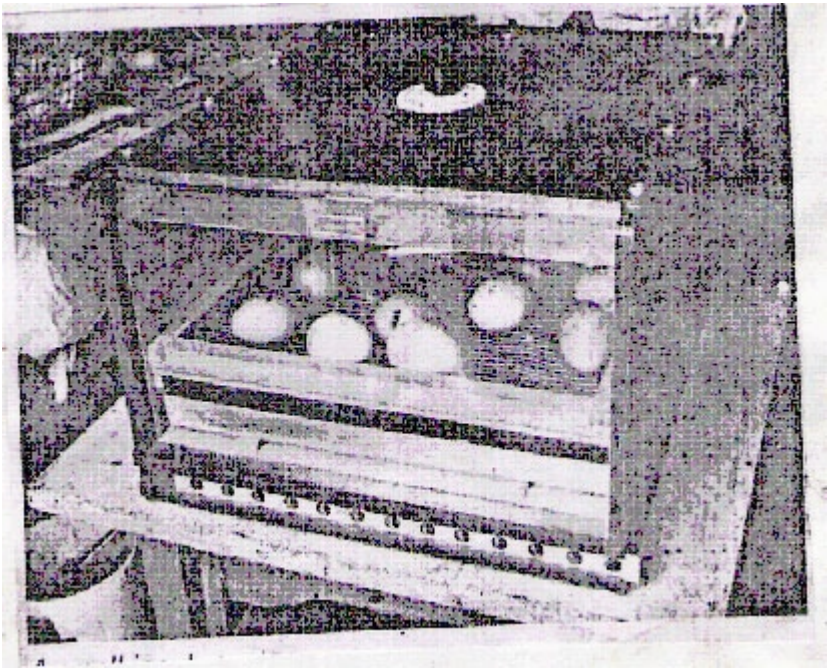

Fig. 3. Flat Type (Table Top) Incubator

The Kerosene Incubator: The difference between the incubators described above and the kerosene type (Fig.4) is in the heating system. The electric incubators are only suitable where electric power supply system is reliable. Often this is not the case in developing countries like Nigeria. Thus the use of kerosene heated small capacity incubators seems more appropriate to rural small scale poultry farmers. The machine is less risky, easy to handle and to operate and more so, the farmer can buy kerosene (of about 20 litres) well in advance.

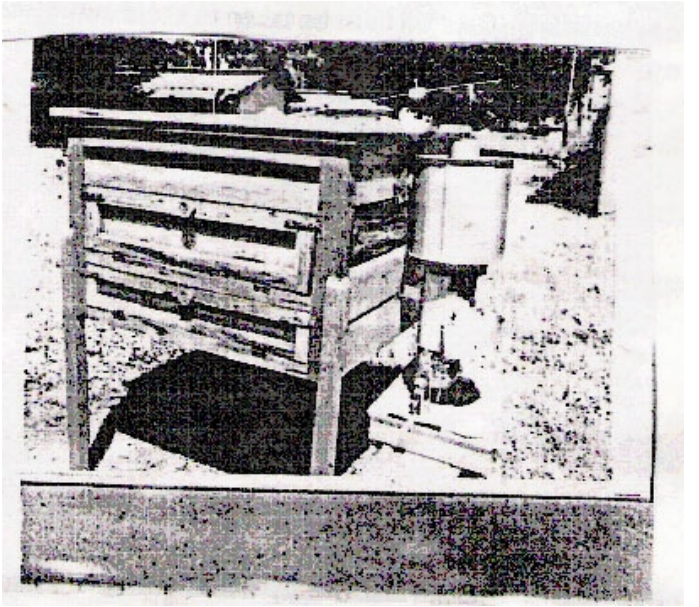

Fig. 4. Kerosene Incubator

The kerosene incubator has a burner, which sends heat into the heating chamber via the kidney shaped humidifier. Heat from the heating chamber is then conveyed into the incubator compartment, which contains the egg trays and a fanel of jute bag just below the egg trays in the incubation compartment. The jute bag fanel serves as a humidifier.

Egg turning in the kerosene incubator is done by hand. Eggs must be turned at least three times daily. It is recommended that the eggs should not be turned for the first 24 hours. Also, for hand turning, it is helpful to mark each egg in pencil with a cross on one side of the egg and a circle on the other to make it easy to see when all the eggs have been turned. Caution

must be taken to avoid getting kerosene on the eggs.

Each incubator is usually sold with an operator's manual that describes the machine and gives operating instructions. A check list of hatchery equipment is as given in Table 3. Such equipment are usually supplied by the manufacturers of incubators and their distributors.

Table 3: Checklist of hatchery equipment.

Egg Handling	Incubation	Miscellaneous
Hatchery Carts	Incubators	Chick boxes
Egg Cases	Hatchers	Chick box racks
Egg flats	Test thermometers	Service tables
Egg graders	Incubation trays	Pressure pumps
Egg candlers	Hatching trays	Tray washers
Vacuum egg lifts		Debeakers
Egg washers		Vaccination equipment
Fumigation cabinets		Incinerators

Electricity Supply: Of special importance to hatchery operations is the need to install a standby electricity generator. This is even more crucial in an environment where erratic power supply is common. Power failure causes the humidity and temperature control systems to fail. Eggs already transferred to hatchers are the most susceptible. Standby generators may be installed to be operated automatically or manually.

HATCHERY OPERATION AND MANAGEMENT

Hatching Egg Source and Handling:

Most hatchery operators raise their own breeding flock. In such a case the quality of the eggs is known. However, there is often a need to obtain hatching eggs from other sources. It is extremely important that the source be thoroughly scrutinized to ensure that eggs so purchased are free from diseases.

Hatching eggs should be clean and their quality should be maintained. If dirty, they may be washed but washing increases the chance of bacterial entrance and is therefore not recommended. Eggs should be collected on egg flats, preferably on plastic rather than fibre flats. The eggs should be cooled and then held at a room temperature of about 18.6°C (65°F) and 75% relative humidity. Eggs lose moisture in storage. How long eggs can be held depends on how frequent eggs are set. Setting eggs twice a week, as is usually done commercially ensures that no egg is held for more than 4 days before setting. After 4 days in storage, hatching time is increased by 30 minutes and hatchability reduced by 4% per day. If eggs have to be held for long periods, the egg cases should be lined with plastic on the inside. This helps to increase humidity which prevents further evaporation from the eggs. Eggs are set with their large ends up. Holding eggs with their small ends up does not have any adverse effect on hatchability. However, for practical purposes, they should be stored with their large ends up in order to reduce labour at setting time. Hatching eggs are usually fumigated prior to setting. Fumigation is usually done with formaldehyde which can kill up to 99% of the organisms on the shell of brown eggs if the fumigation is done with 3x formaldehyde concentration for 20 minutes. Formaldehyde gas may be produced by mixing a 40% formalin solution and potassium permanganate ($KMnO_4$), or from paraformaldehyde powder. Table 4 gives the quantities of formalin plus or paraformaldehyde powder needed for different formaldehyde strengths and the conditions for use.

Table 4: Fumigation levels under different conditions of usage

Conditions for use	Formaldehyde strength	Quantities needed to produces the required formaldahye gas) K		Paraformaldehyde Powder required to produce equivalent amount of gas (grams)	Fumigation time (mins)
		Formalin (Co)	$KMn0_4$ (grams)		
Hatching eggs immediately after they are laid	3x	120	60	30	20
Eggs inn incubators (1^{st} day only)	2x	80	40	20	20
Incubator room	1x	40	20	10	30
Chick in hatchers [2]	1x	40	20	10	3
Hatcher (between hatches)	3x	120	60	30	30
Hatcher, chick room (between hatches)	3x	120	60	30	30
Chick boxes, pads	3x	120	60	30	30

1 Source Mark O. North, 1984; Commercial chicken production Manual Formaldehyde Gas is very toxic, therefore apply a neutralizer (ammonium after fumigation)

Care must be taken when using formaldehyde. Avoid inhalation and direct skin contact. For mixing formalin and permanganate use an enamelware or earthenware vessel of large capacity because of the boiling, foaming and splattering that occur when the two are mixed. Always place the vessel and permanganate in the fumigation area before adding the formalin. Never add the permanganate to the formalin.

Before setting eggs in the incubator it is necessary to sort and grade them out. Eggs with thin or porous shells and those that are very dirty, cracked, mis-shappened, too large or too small must be removed. The extent of further grading depends on whether the chicks are to be sold or reared on the farm. It chicks are to be sold, grading for size and quality is very important. With breeder-type hatching eggs, egg weight and quality are of greatest importance and must be graded carefully.

Eggs should be trayed as close to setting time as possible, although sometimes it may be more labour efficient to tray the eggs everyday and store by placing them in special holding racks designed for the purpose. About six hours before setting, the eggs should be warmed to room temperature. At the time of traying, attach a record card containing the source of eggs, type and date of setting.

Proper planning and scheduling of egg setting and chick hatching is an important hatchery management practice. Set eggs at such a time that the chicks will be pulled in time for convenient collection and transportation by customers. Avoid hatching on public holidays and work-free days.

Egg Candling:

Conventionally, eggs set are candled twice during incubation, from the fifth day (for eggs with white shell) to seventh day (brown shell eggs), to remove the infertiles and those with dead embryos and from the fourteenth to the eighteenth day to remove eggs whose embryos died after the first candling. Candling (fig. 5) involves passing light through the egg in a darkened room to reveal the internal contents.

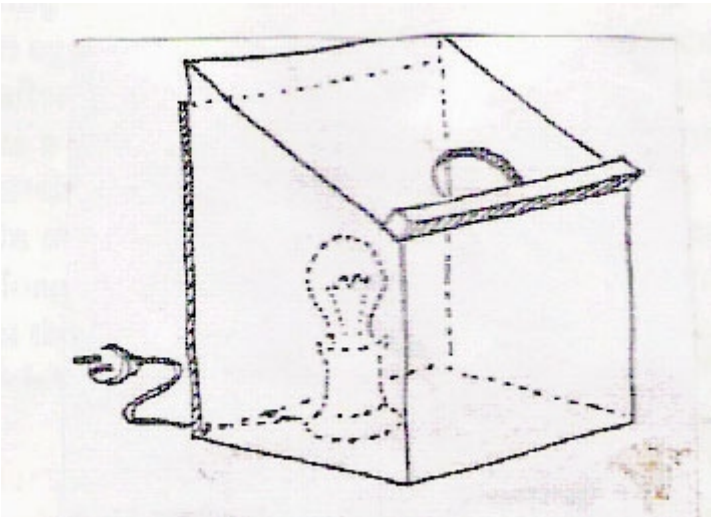

Fig. 5: The Home-made Egg Candler (egg placed against a hole)

At about the seventh day of incubation, an infertile egg looks clear, except for a floating shadow, which is the yolk. A fertile egg on the other hand shows a small, dark spot representing the developing embryo, with a mass of little blood vessels radiating in all directions, if the embryo is living. These (the embryo and the mass of blood vessels) give a spider-like appearance. If the embryo is dead, the blood settles away from the embryo toward the edge of the yolk forming an irregular circle of blood known as blood ring. Eggs with living embryos are dark and well filled up on the eighteenth day, showing a clear, distinct line between the air cell and developing embryo. Those with dead germs on the eighteenth day show only partial development and there is no clear line of demarcation between the air cell and the rest of the egg content. Figure 6 shows the inner contents of eggs after 9 days of incubation.

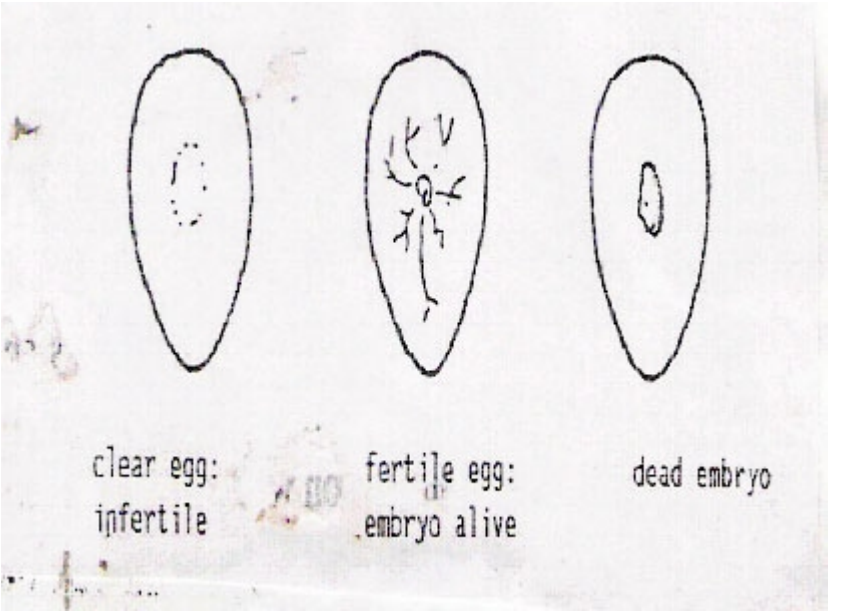

Figure 6: Candling eggs for fertility and dead embryos.

Because of the labour involved and the relatively few eggs removed from the incubator which does not add much space, many operators of cabinet incubators candle once during incubation. Some do not candle at all. However, records of infertile eggs are important indices for assessing breeder flock performance.

Chick Handling

Chicken eggs are normally transferred from the incubators into the hatchers after 18 days. Between the time the first and last chicks hatch, there is a time lapse of 32-35 hours. This means that some chicks may hatch on the 20th while others hatch on the 21st day of incubation. In order to ensure that chicks which hatch early are not kept for too long, it is important to pull the chicks and process them rapidly so that they can be delivered to the farms within 12 hours after the entire hatch has been removed.

If there is no problem with delayed hatching, the hatch should be ready to be pulled out early on the 22nd day. Before pulling out the hatch, the chick boxes should have been assembled and ready for the chicks. Pull out the hatch one tray at a time. Remove the healthy chicks from the hatching trays and count as they are being placed into chick boxes. Poor quality chicks such as those with unhealed navels or those having some deformity should be left in the trays and should be disposed off along with the empty shells, unhatched eggs and other hatchery debris. Keep a record of saleable chicks and total hatch from each day. Such data used in combination with fertility results are important diagnostic tools should problems arise. Based on experience, a system should be worked out that will ensure a smooth labour efficient process for pulling out the hatch, counting the chicks, putting them into boxes, keeping records and disposing of hatchery debris.

With a small hatch it may be necessary to allow the chicks to stand in the boxes for about four to five hours to allow them "harden" before further processing. With a large hatch, however, the first set of chicks pulled out may be ready for further handling by the time the whole hatch has been pulled out.

HATCHERY SERVICES:

The number of services rendered by hatcherymen varies among hatcheries, but usually include sexing, vaccination and debeaking.

Sexing

In egg production, chicks are usually separated into cockerels (male) and pullet (female) at hatching time. Raising pullets without cockerels allow the pullets to develop more uniformly. Chicks can be sexed by three ways. They may be sexed on the basis of down colour (colour sexing), in certain crosses by the relative length of the primary wing feathers (feather sexing) and by the examination of the rudimentary copulatory organs (vent sexing or "Japanese" method). By making some specific mating, breeders have been able to produce progenies with the cockerel chicks having down colour or rate of growth of the primary wing feathers different from those of the female counterparts at hatching. In this type of cross, which is referred to as "sex-linked cross", the hens transmit their characters (i.e. down colour pattern or rate of growth of the primary wing feathers) to the cockerel chicks only. Examples of such crosses are: (a) mating Rhode Island Red (RIR) males with Barred Plymouth Rock (BPR) females. The barring characteristic in the (BPR) female is sex-linked and is therefore transferred to the males. At hatching, the cockerel chicks have a white spot on the head and yellow shanks while the pullet chicks are completely black with black shanks. (b) mating White Leghorn (WL) male (has rapid feathering characteristic) with RIR females (slow feathering). The male progeny is slow feathering and the female progeny rapid feathering. Slow feathering is sex-linked trait and at hatching, the primary wing feathers of the female chicks are relatively longer than the coverts feather. While in the females, the primaries wing feather are shorter than the coverts feather . Fig.7 illustrates chick sexing by rate of feathering (i.e feather method of sexing).

These two methods of identifying the sexes are less expensive than Vaccination:

Most of the vaccinations are done outside the hatchery. However,

the "Japanese" method which requires good eyesight, nimble fingers and a lot of experience for speed and accuracy. Of the three methods, colour sexing is the most commonly used in this country.

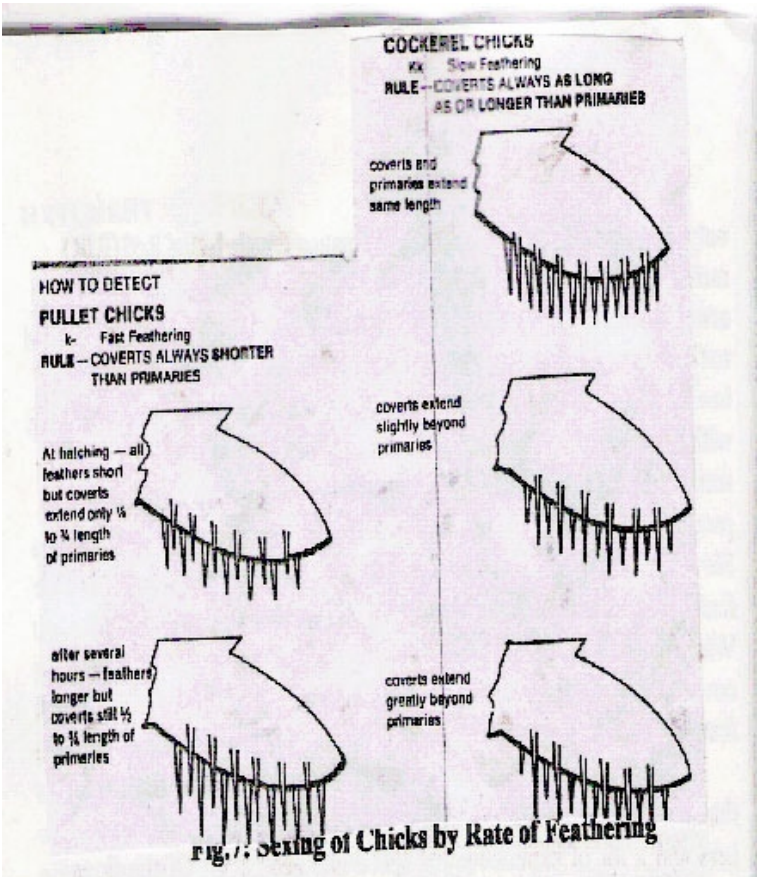

Fig.7: Sexing of Chicks by Rate of Feathering

many hatcheries vaccinate against Marek's disease at day-old. This disease usually affects young growing birds and is presently becoming a serious problem in Nigeria. Some hatcheries also vaccinate against Newcastle disease (NCDV) at day-old, the very mild form of the vaccine is usually used. Many of our hatcheries vaccinate against only one disease, the rest are done at customers' request and at maximum charge. It is important to know the type of vaccination given before collecting your chicks from the hatchery.

Debeaking:

Chicks may be debeaked (fig. 8) at day-old, especially if such chicks are meant for broiler production, there is the need to debeak them. For egg-type chicks, debeaking at this age will require a second debeaking later in life, before they start laying. Day-old debeaking can be done in two ways, by cold debeaking using a cold knife or scissors and by hot debeaking with the aid of a debeaking machine with a hot cauterizing blade. Electric debeaking machines are locally available.

Fig. 8: A Properly Debeaked hen.

Before putting in an order for day-old chicks, it is advisable to have prior information about the hatchery, as regards the quality of the chicks and the services such a hatchery can render.

Chicks Transportation

Chicks ready for delivery should be transferred into the chick holding room. Before chicks leave the hatchery be sure that records of breed, fertility, hatchability, per cent hatch, number of saleable chicks and culls have been properly documented. It is customary to give 2-4 extra chicks per box to cover any mortality that may be encountered during transportation. The safe delivery of chicks is the last important step in hatchery management.

Whether the customer comes to collect the chicks or the chicks are to be delivered by the hatchery, it is necessary to ensure that the mode of transportation is appropriate for day-old chicks. Chicks closely packed together generate a lot of heat and so there must be adequate ventilation to remove excess heat. The car boot for example can only be used for short distances. Over long distances, the chicks will get suffocated before reaching their destination especially if this is done during the hot season. Regardless of the mode of transportation, adequate ventilation, protection from rain and cold are critical for chick survival during transportation. Customers must be given adequate information about the breed, anticipated performances and vaccination records of the chicks they purchase. A short guide containing such information should accompany all chicks delivered

SANITATION AND DISEASE CONTROL IN HATCHERY MANAGEMENT

The need for proper sanitation and disease control in hatchery operations cannot be over-emphasized. The proper design and construction of hatchery buildings and its importance in disease control

have already been discussed. Following is a summary of other hatchery sanitary procedures:-

1. Fumigate all eggs soon after collection.
2. Sort out dirty eggs and cracks as soon as possible and dispose them immediately.
3 If hatching eggs are to be purchased elsewhere, ensure that they are from a disease- free flock and of good quality.
4 Fumigate soon after arrival.
5. Setting and hatching trays should be thoroughly washed and disinfected after every hatch. Use pressure washers.
6. Similarly, the incubator and hatcher rooms should be thoroughly washed and disinfected after every hatch. All rooms in the hatchery must be washed regularly and kept spotlessly clean. Table 5 gives a list of common poultry disinfectants and their uses.
7. Dispose hatchery debris properly.
8. Personnel and visitors must always be regarded as possible agents of disease and must therefore be cautiously guarded, regardless of their status.
9. Fumigation of incubator, hatcher and chick rooms between hatches is strongly recommended.
10. Fumigation of chicks is generally not recommended, but if there is an outbreak of omphalitis or pullorum, it becomes necessary to fumigate.

The common poultry disinfectants and their uses are given in table 5.

Hatchery Waste Disposal:

Hatchery wastes consist of infertile eggs, non-hatched eggs, dead, weak or unsalable chicks, egg shells and membranes. These wastes should be properly disposed of, otherwise they can be a source of disease infection in the hatchery. Two effective methods of disposing these wastes are by burning in specially constructed facilities (incinerators) and by burying deep enough not to be dug by rats, dogs or other animals. The wastes can be processed into feed as poultry by-product

Table 5: Common Poultry Disinfectants and their uses.

Properties	Iodophors and uses	Quaternaries	Coal Tar	Synthetic Phenols	Hypochlorites Distillates
Spectrum of Activity					
Gram-positive bacteria	Effective	Effective	Effective	Effective	Effective
Gram-Negative bacteria	Effective	Effective	Effective	Effective	Effective
Bacteria spores	Moderately-effective	Not-Effective	Not-Effective	Not-Effective	Moderately-effective
Fungi	Effective	controls some form	Most types effective	Most types effective	
Animal viruses	controls some form	controls some form	Controls some form	Controls some form	Controls some form
Physical properties					
Speed of kill	Very Rapid	Very Rapid	Rapid	Rapid	Very rapid
Resistance to organic debris	Poor to fair	Fair	Excellent	Good	Very poor
Residual activity	No	Yes	Yes	Yes	No
Affected by hard water	Not effected	Reduces speed	Some	Some adversely	Not affected adversely affected
Compatible with nonionics	Yes	Yes	No	No	Yes

HATCHERY RECORDS AND PERFORMANCE EVALUATION

It is necessary to evaluate from time to time all quantifiable factors associated with successful operation of the hatchery. Good records are the necessary tools needed for such evaluation. It is important to use few records but they must give the needed information. Records should be designed to give the following categories of data:

a) Hatchability Data: This should cover, the number of eggs set in the month, Incubator capacity utilization, chicks hatched per month, per cent hatch, hatchability, percentage of culls, total saleable chicks, number of extras, number of chicks destroyed. An example of a hatch report is given in Fig.9.

b) Cost Analysis: Cost of egg production or procurement, egg cost per chick hatched, egg cost per chick sold, total cost of hatching and selling one chick.

b) Miscellaneous data: Include wages for all hatchery employees including those involve in egg procurement and chick sales, chicks hatched per employee and chicks sold per employee.

Fig.9: Manager's Hatch Report

Flock No. cases set	No of set	No eggs Chicks	No. Total outs	%Total Hatch		No Grade	Hatch date			
				Act	Std		%Grade outs	% Extras	Saleable Chicks	
									No	%
Total										

Egg cost per dozen eggs:..... Total chicks sold:.....

Egg cost per saleable Chick:..... *Orem Product Chicks destroyed:.....

Other costs per saleable chick (est):..... Total saleable chicks hatched:.....

Total cost per saleable chick:..... Estimated number of saleable chicks next hatch:.....

Source: Mack O. North, Commercial Chicken Production Manual,1984.

All data should be summarized from month to month and comparisons made with previous performances and expected performance standards. Such comparisons help to identify any improvements or deficiencies in the production system.

The following computations are commonly used for assessing breeder flock and hatchery performances:

(a) % Fertility = $\frac{\text{No. of fertile eggs x 100}}{\text{No. of eggs set}}$

(b) % Hatchability = $\frac{\text{No of Chicks hatched x 100}}{\text{No. of fertile eggs}}$

(c) % Hatch = $\frac{\text{No.of Chicks hatched x 100}}{\text{No of eggs set}}$

(d) Incubator capacity Utilization (ICU) = $\frac{\text{No.of eggs set per year}}{\text{Incubator capacity per year.}}$

The maximum ICU for chicks is 17 and for turkey is 13

FACTORS RESPONSIBLE FOR POOR HATCHABILITY

Numerous factors interact to cause poor hatchability. Table 6 gives a list of common problems, possible diagnosis and suggested remedies.

Table 6: Incubation trouble - shooting chart

Symptom	Probable Causes	Suggestions
	1. Too many or two few males	1. Use 1 male to 10 to12 females with leg horns and 1 male to 8 to 10 females with heavy breeds.
	2. Males undernourished as evidenced by poor fleshing and shrinking of comb and wattles	2. Replace under-weight males with vigorous males in good condition. Provide feeders in roosts Dub Leghorn males.
Many clear showing no development infertiles	3. Interference of males during mating	3. Do not use too many males. Raise males eggs together. Provide temporary partitions or blinds in large pens when breeders are confined.
	4. Males too old	4. Use cockerels instead of old males unless the latter are proven valuable breeders
	5. Preferential mating in pen matings	5. Artificially inseminate infertile hens or put with another male in different pen.

	usually in pen mating	
	7. Eggs held too long. Eggs chilled by holding at too low a temperature.	7. Set eggs within 7 to 10 days after laying. Hold eggs where the temperatures is between 40°F (4.4°C) and 60°F (15.6°C)
Blood rings	8. Improper temperature	8. Check accuracy of thermometer. Check thermostat, heating element, current supply; check operating temperature against manufacturer's instructions.
	9. Improper fumigation	9. Do not fumigate at high concentrations during the first days of incubation.
	10. Holding eggs at temperatures above 80F(26.7°C) before incubation.	10. Hatching eggs should be held where the temperature is below 80°F (26.7°C) preferably below 60°F. 15.6°C) And 40F. (4.40C)
	11. Temperature too high or low.	11. See suggestions (10)
	12. Improper turning of eggs	12. Turn at least 3 times preferably 5 or more in 24 hours.
Many dead germs.	13. Breeding (low hatchability Inherited)	13. Avoid close in breeding
	14. Improper ventilation, insufficient oxygen	14.Increase ventilation of incubator and incubator rooms, avoid drafts. Add oxygen at high altitudes
	15. Pullorum disease or other salmonelloses	15. Use eggs from disease free sources only.
Pipped eggs not hatched	16. Insufficient moisture	16. Increase evaporating surface for moisture or increase sprays. Chickens: first 18 days, wet-bulb: 85-87°F (29.4-30.6°C) 3-day hatching period, 90°F-92°F(32.2-34.4°C. Turkeys first 24 days wet- bulb:87-88°F (30.6-31.1°C. 4-day hatching period 90-92°F (32.2-34.4°C.

Hatching too early Hatching too late Sticky hatch	17. Too high temperature	17. 17-19 See (8) for all three. Check temperature at maximum or when current actually goes off. During hatching period check temperature after current goes off to see if it increases further.
	18. Too low temperature	18. Ditto
	19. Probably too high temperature	19. Ditto
Spraddlers malformed chicks	20. Temperature too high	20. See (8)
	21. Too low mositure	21. See (16) above
	22. Improve turning or setting	22. See (12) above. Set eggs large end up.
	23. Hatching trays too smooth.	23.Use trays with wire or crinoline on Bottom.
Abnormal chicks. Weak Chicks Small Chicks	24. Overheating in hatching unit	24. See (8)
	25. Small eggs	25. Set only standard or larger size eggs.
Laboured breathing	26. Insufficient moisture	26. See (16) above
	27. Too much fumigant Respiratory disease (bronchitis or Newcastle)	27. Ditto
Large, soft-bodied, mushy	28. Low average temperature	28. See (8) above

Mushy chicks, on trays	29. Poor ventilation	29. See (14) above dead
	30. Navel infection (omphalitis) in Incubator	30. Carefully clean and fumigate between hatches.
Rough navels	31. High temperature or wide temperature variations.	31. See (8) above.
Hatching too late or not Uniformly	32. Old eggs and eggs of different ages.	32. Set eggs at least once each week.

Source: M.L. Sunde, 1984. Poultry Science Lab. 101.

SUMMARY OF HATCHERY MANAGEMENT PRACTICES

For successful hatchery operations ensure:

- Proper hatchery design with rooms for receiving eggs, Traying, Fumigation, Incubators, Hatchers, Sexing, Packing and Dispatch .
- Maintain thorough disinfection, cleanliness and prevent any unnecessary traffic in the incubator room.
- Proper turning of eggs during incubation must be observed.
- The temperature and humidity readings should be checked three times daily, morning, afternoon and evening.
- Provide adequate ventilation to facilitate inlet of oxygen and outflow of carbon dioxide.
- Strictly follow the manufacturer's instructions on the running of incubator.
- When packing, dispatching and transporting the chicks, care must be taken to prevent them being chilled or suffocated in transit.
- Good hatchery records should be kept for performance evaluation.

GLOSSARY OF TERMS

Ambient temperature: Is the temperature in the surrounding environment.

Candling: The art of passing light through an egg or eggs in a darkened room to reveal internal contents.

Embryo: A bird in the earliest stages of its development in the egg.

Fumigate: To expose to fumes, especially to disinfect or kill disease agents.

Hatch: To bring forth young from an egg or eggs.

Incubation: The process of subjecting selected eggs from mated flocks to proper conditions outside the birds body for the embryo to develop and hatch into a chick.

Incubator: Machine into which eggs are usually set for hatching.

Infertile: Sterile; incapable of or unfit for reproduction. In the case of an egg one, which shows no germ.

Relative humidity: The amount of water vapour in the air divided by the amount of water the air could contain expressed as a percentage.

Sexing: Separation of the male chicks (cockerels) from the female chicks (pullets) after hatching.

Sex linked: Of genes located on the sex chromosomes e.g. silver and gold colour of certain breeds of chickens.

Vaccination: Inoculation of a bird with attenuated microorganisms or viruses to enable it to build up immunity to a specific disease.

Bibliography

Asaolu Sunday 1996: Incubation and Hatching of Quail Eggs. Paper presented at Quail Adoption and Health Management in Nigeria, A Training Workshop held at NVRI, Vom, August, 1996.

Card, L.E., and M.C. Nesheim, 1972: Poultry Production 11th Ed. Lea. and Febiger, Philadephia.

Clemson University Co-operative Extension Service, 1981. Incubating eggs of domestic birds. Circular 530, Clemson University, South Carolina.

Ministry of Agric. Fisheries and Food (1981): Artificial Incubation in Small Incubators, Leaflet 341, Pub. Lion House, Willowburn

Nico Van Wageningen and Johan Meinderts (1990) Hatching Eggs by hens or in an Incubator Agrodok 34, CTA Pub. Agromisa, P.O. Box 41 6700 aa Wageningen, the Netherlands.

North, M.O. 1984: Commercial Chicken Production Manual. 3rd Ed. AVI Publishers.

Sunde, M.L., 1984. Poultry Science Lab.101. Lecture Notes for Poultry Science and Practice Class. University of Wisonsin Madison, Fall, 1984.