

SHIKABROWN® CHICKEN:

BEST CHOICE FOR PROFITABLE EGG PRODUCTION AND MARKETING IN NIGERIA



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History of the development of Nigeria breed of poultry dates back to the pre-independence and regional governments' times with successes and failures. However, the National Animal Production Research Institute (NAPRI) after decades of research work has been able to produce the first Nigerian laying strain of chickens known as Shikabrown®. This Nigerian-made strain has been tested and proven as very good on private/commercial farms. The birds are well adapted to tropical climate. If good management is maintained high economic returns on investment are envisaged. This bulletin is however aimed at providing information on management practices that are needed for attainment of the highest level productivity from Shikabrown® chicken. We wish to acknowledge West African Agricultural Productivity Programme (WAAPP) for funding the publication of this bulletin. The efforts of all researchers who developed Shikabrown® chicken at NAPRI are highly appreciated. Our thanks also go to our colleagues who contributed in no small measures to ensure the success of this bulletin.

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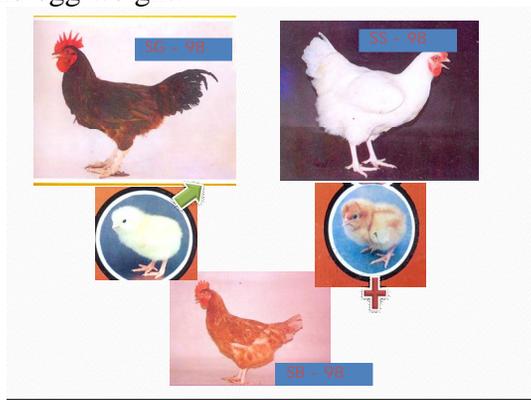
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1.0 INTRODUCTION

Shikabrown® layer is the result of over fifteen years of active breeding and selection work by scientists at NAPRI. Numerous scientists of Universities and other higher institutions of learning across the country have tested the commercials. Shikabrown® was developed to cope with harsh tropical environment. It has been tested to give very good performance in all the ecological zones of the country. The bird is well adapted to tropical climate and gives the best economic returns. It is hardy and resistant to many diseases hence less investment on drugs will be required. If all guidelines written in this bulletin on rearing and caring of the birds are provided, good economic returns are envisaged.

Geneticists and research scientists at the National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Shika, Zaria have worked dedicatedly for over twenty years to synthesize and produce a brown egg layer with excellent shell quality, production rate, persistency, liveability, feed conversion and egg weight.



Breeding process .

It is hardy and highly adapted to harsh tropical environment. These traits are the primary factors determining profit for farmers. The farmers are however advised to make it their goal

to achieve the production potential that has been breed into the Shikabrown® layer.

The purpose of this bulletin is to outline those management practices that research and experiences have shown as important to attain optimum performance from the Shikabrown® layer. Performance goals and management recommendations are provided, and, if the management practices are followed, they help the producer to achieve the goals. Good poultry management is the key to success with Shikabrown® layer. It simply requires attention to all details of the flock's needs, common sense, and proper decision making throughout the flock's lifetime. This bulletin is expected to aid in obtaining consistently good results with Shikabrown® layer and its parent stock.

2.0 SPECIAL ATTRIBUTES OF SHIKABROWN®

The Shikabrown® chicken under standard management and good husbandry has the following performance indicators as shown in Table 1 below:

Table 1: Performance indicators for Shikabrown®

S/N	Productive parameters	Performance indicator
1.	Rearing period livability	94%
2.	Age at first egg	136 days
3.	Age at 50% egg production	168 days
4.	Age at peak egg production	189 days
5.	Number of weeks above 80% egg production 9	
6.	Hen house egg production to 72 weeks	278
7.	Hen-day egg production to 72 weeks	290
8.	Laying period livability	90%

9.	Body weight at maturity(40 weeks)	1.9 kg
10.	Average egg weight at maturity	62.5 gm
11.	Body weight at end of lay (72 weeks)	1.8kg

The performance indicators of Shikabrown® as highlighted above compares favourably well with most egg laying strains all over the world coupled with being indigenous and well adapted to the tropical poultry production environment. The performance indicators in this bulletin are an indication of what can be achieved. While flock management, diseases and other factors can substantially affect performance, the information is based on actual flock results obtained under good environmental and management conditions.

Variations above and below these levels may, and probably will occur for one reason or the other. These data should not, therefore, be regarded as specifications or standards but as performance objectives. With strict attention to farm management, nutrition, sanitation and with the assistance of the following information, we believe your flock will achieve the production target.

3.0 MANAGEMENT OF SHIKABROWN® BIRDS

3.1 Brooding

Brooding is the act of caring for young chicks after hatching. It involves the provision of necessary factors for the survival and rapid growth of chicks. Such factors include heat, light, humidity, ventilation, feed, water and diseases control.

3.1.1 Brooding house and equipment

Features of brooding and brooding house should include the followings:

1. Heater, lantern, charcoal infrared (radiant), gas brooders, or forced-air furnaces.
2. Supplemental waters or mini drinkers in addition to the automatic waters.
3. Supplemental feeders and feed spread on the paper.
4. A brooder guard enclosing chicks.
5. Good ventilation.

3.1.2 Management schedule during brooding of Shikabrown® chicks

The management schedule for brooding of poultry chicks can be divided into management practices before and after the arrival of chicks.

Preparation for arrival of chicks

Preparation for arrival of chicks involves decision about where to purchase healthy and quality hicks; when to make the brooding house ready; how to transport chicks from the point of purchase and what to do on the day of arrival of chicks.

Preparation of the brooding House

Getting the brooding house ready at about 3 weeks before the chicks arrive requires doing the following:

- Make necessary repairs.
- Purchase necessary equipment.
- Disinfect and fumigate the house.
- Wash the house.

Brooding activities two days to arrival of Shikabrown® chicks

- Sweep the house and clean the equipment.
- Put litter on the floor.
- Cover the litter material with rough brown paper or old newspapers.
- Assemble all equipment.

- Test all equipment to make sure they are in proper working condition.

If a half-open sided house is to be used, cover the open side with plastic sheets, thick cardboard paper, native mats, empty feed bags or any other suitable material.

Activities during transportation of Shikabrown® chicks

Transport Shikabrown® chicks as fast as possible. Chicks should be transported during minimum temperature period of the day (early morning or in the evening). Farmers should ensure that the chicks are adequately ventilated while in transit, for example the chicks should not be locked up in the trunk (boot) of a car while in transit.

Brooding activities on arrival of Shikabrown® chicks

On the day of arrival of chicks, poultry farmers should do the followings:

- Fill the drinkers with medicated water.
- Put on the heat source to warm up the room.
- Place feed in the feeders.
- Some feed may also be sprinkled on the paper covering the litter.
- Flat egg trays and box tops may also be used as feeders during the first week.

After stocking of Shikabrown® chicks the farmer should stay and watch them for about an hour and make sure that the chicks are comfortable. Chicks have the tendency to crowd around corners of the building especially when frightened or feel cold. Piling can lead to mortality. It is therefore advisable to round off any sharp or square corners of the house with boards, bricks or jute sacks in order to prevent piling.

The poultry farmer/attendant is expected to count the chicks as he puts them in the brooder. All deformed or dead chicks should be removed. Weak chicks should be guided to drink water by putting their beak slightly in the water container. If chicks are transported over long distances by road, the addition of glucose (or sugar if glucose is not available) to the drinking water may increase their survival rate.

Key Points to note during brooding of Shikabrown® chicks

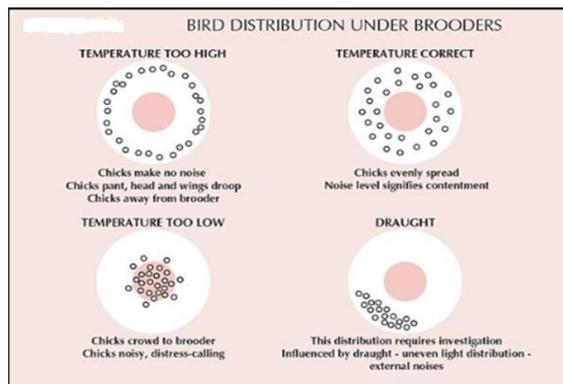
- Surround the brooding house with thick nylon.
- Maintain temperature of between 30° and 35°C within the first one week.
- If the heat intensity is too high, the chicks will move away from the source of heat.
- If birds are evenly distributed and scattered around the house, then the environment is conducive.
- Wood shavings must be kept dried during the brooding period.
- Prevent water spillage.
- Use shallow feed trough in the first four weeks.
- Provide clean and fresh water.
- Provide good ventilation.
- Avoid feed wastage.
- Reduce environmental stress (shouting or horning).
- Remove any dead or ill health chicks from the pens.
- Do not allow visitors(s) to enter the brooding house.
- Feed chicks without restriction (*ad Libitum*).
- Note that feed consumption increases as the chicks grow in age.
- Make provision for the attendant to sleep on the farm in the night.
- Give necessary medication and vaccination.
- Provide a tray feed for 20-30 chicks and 1 fountain drinker for the same

Number of 20 – 30 chicks.

Chicks brooding Troubleshooting

Poultry farmers should look for the followings (see figure 1 below) when troubleshooting during brooding of chicks:

- Are the chicks spread out over the floor area and at the feeding and watering equipment? If so, then the chicks are comfortable.
- Are the chicks panting and gasping? If so, they may be too hot or have a disease condition.
- Are the chicks grouped close to the heat unit or huddling and piling in small groups? If so, they are too cold.
- Are feeders and drinkers being crowded? If so, there is no enough space.
- Is the litter packed and wet? If so, improve the ventilation and /or put new litter (saw dust).
- Is ammonia odour strong in the brooding house? If so, improve ventilation and/or change litter.



3.1.3 General considerations for successful brooding of Shikabrown® chicks

Preparation:

Clean, disinfect and check all equipment, including feed bins. A thorough cleaning and disinfection of the brooder house and all equipment is the best starting point when preparing for chicks. Provide clean, dry litter (e.g. softwood shavings). Have the brooder house ready and start the heating system at least 12 hours before chicks arrive during the cold period. Check all equipment thoroughly to see that they are in good working order.

Isolation:

Strict isolation of young chicks is essential for the control and prevention of poultry diseases. Allow no visitors and keep the house locked. Keep brooding chicks as far away from older birds as possible. Avoid any traffic between older birds and young chicks. "All-in" and "all-out" brood-growing programmes should be practiced. Place a footbath containing a disinfectant solution at the entrance to the house. Renew the solution daily. Ensure that all personnel disinfect their footwear before entering the brooder house.

Brooders:

A controlled and constant source of heat is necessary to maintain the chick's body temperature at proper level. The temperature should be 90°F (33°C) at chick level. Adjust temperature down 5°F (2.8°C) per week until the house temperature reaches 65°F (17.8°C). The chick distribution and behaviour are ideal indicators of optimum brooding environment. Comfortable chicks will be evenly distributed within the brooder guard. If the temperature is too low, the chicks will crowd around the source of heat, and if too high, they will move more towards the edges of the brooder guard.

Brooder guards should be used to confine chicks close to the heat for the first few days. Remove the guards when the chicks are 7-10 days old.

The extra touch:

We strongly recommend that frequent visits be made by the attendant during the first two weeks to make sure that the chicks have plenty of feed and water, and to see that heat and ventilation are proper for the chick's comfort. Nightly visits are necessary to make proper adjustments for temperature. Extra visits in the beginning mean extra pullets in the end. Avoid spilling water in the brooder house. If it occurs, replace wet litter with dry ones immediately.

3.2 Management of Growing Shikabrown® Pullets

At eight weeks of age up to point of lay (at about 20 weeks) the birds are called growers. The emphasis here is to care for them properly to produce the required physiological development for efficient egg production. At this stage the birds consume more feed and grow less. Standard feed must not be compromised.

- Care, attention and monitoring given at the chick stage should be continued at this stage.
- Environmental temperature is less than that required for chicks because they have fully grown feathers for insulation. Room temperature is sufficient at this stage.
- Relative humidity required at this stage is 50 – 80%.
- More ventilation is required here than the chicks. Ensure maximum ventilation by using open sided houses.
- Provide adequate quantities of balanced feed 15 – 16% crude protein, 2,400 -2,600 Kcal per 1kg diet should be provided. The low protein and energy diet provided is to slow down their growth and development to avoid precocious fat deposition.
- Growers can be reared in deep litter or cages.

- Equipment for rearing includes drinkers and feeders. The chick feeder and drinkers are replaced with trough feeders that are deeper and narrower to prevent feed wastage where it can be afforded automatic drinkers should be used.
- Towards the end of the growing phase (at 18 weeks) the birds should be transferred to the laying house that is higher cages or deep litter. Transfer should be done at the coolest part of the day and antistress should be administered in the water after transfer to minimize stress.
- Debeak and Despus the birds between 10- 13 weeks of age Deworming should be done every 8 weeks.
- Aim of growers management is to produce birds that will lay noemal sizeable eggs. The emphasis here is to produce birds that have developed properly their reproductive system.
- At this stage the birds depend on natural day light to feed artificial light is not provided.

The effort made during the growing period to control feeding and lighting programme will largely determine the success of the laying flock. By properly controlling the feed and lights, the development of the breeder/layer flock can be regulated to produce a trim, healthy and properly developed bird. Extra lighting at night should be provided for the first 6 weeks of life. After 6 weeks, light at night should be discontinued until the pullets are about 20 weeks when lights are gradually introduced until a day length of about 14 hours is achieved. A good lighting programme is necessary to ensure correct sexual maturity for females.

Table 2 below gives the feed allowance guidelines. The birds should be fed “chick mash” from day-old to 6 weeks of age and “grower mash” until they lay at least an egg. The chickens

should be placed “on layer/breeder mash” preferably when they have reached 5% egg production. The objective of the feed allowance guidelines is to produce a pullet with good skeletal and muscular development. The birds should carry a minimum of fat since excess fat is detrimental to the performance of the pullets. Monitor body weight every one to two weeks during the 6 to 20 week age period so that feeding programmes can be altered when flocks are not maturing properly. If optimum performance is to be achieved, pullet body weight must closely conform to the guide.

Table 2: Shikabrown® female target body weights and feeding allowances

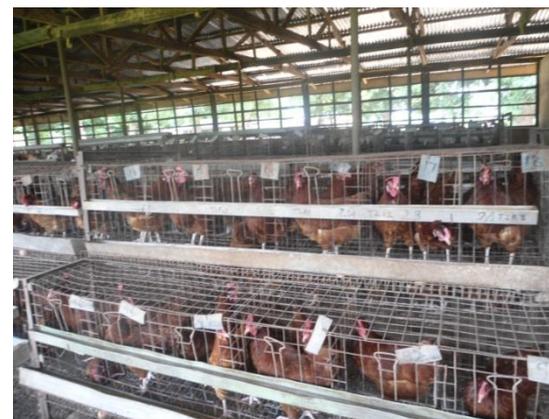
Age (wks)	Body weight (gm)	Feed gm/h/wk	Type of ration
0-6	421.3	1051.76	Chick Grower
7	433.3	318.66	“
8	505.8	361.50	“
9	509	407.20	“
10	538	466.33	“
11	608	531.52	“
12	717	557.40	“
13	832	548.94	“
14	948	613.82	“
15	1023	503.20	“
16	1084	551.44	“
17	1157	522.20	“
18	1182	549.76	“
19	1208	611.40	“
20	1253	646.08	“

This information in the Table 2 above was developed assuming the ration recommended in the section on nutrition and an

average daily temperature of 27⁰c are maintained. Slightly more feed will be required when birds are reared at cooler temperatures. At a temperature above 30⁰c it may be necessary to ensure that feed is available to the pullets during the cool hours of the day to reach body weight target.

3.3 Management practices for Point of Lay Shikabrown Chicken

Move the pullets to thoroughly cleaned and disinfected laying house by 18-20 weeks of age. Have house cleaned and sanitized with all equipment in place before the birds arrive. The “all-in, all-out” housing system is recommended because it helps break the disease cycles that so often accompany a continuous multiple replacement system.



Floor space:

Maximum egg production and egg size require that ample feed and water space be provided. Adequate floor space (or cage space) per bird should also be provided for optimum performance.

Litter:

Clean, dry soft wood shavings are preferred for pullet going into new quarters. Avoid dusty or wet litter that may harbour mould. Promptly remove any caked or wet litter during the laying period.

Nest:

Nest should be made available at least one week prior to the beginning of egg production, for birds on deep litter. Use the conventional two tier nests with 12" x 12" x 12" (30.5cm x 30.5cm x 30.5cm) compartments and provide one individual compartment per 4 birds. Proper nest management is essential to ensure clean hatching eggs and increased hatchability.

Records:

It is important to keep accurate records of flock. Record daily feed intake, egg production, mortality, vaccination, medication, or unusual flock symptoms. Be aware of sudden drop in feed consumption since this usually indicates a stress, disease, or management problem.

Feeding during laying period:

The rate of egg production and the body weight should govern the amount of feed used during the laying period. The energy levels of the feed affect the amount required. Judgement in feed allotment to lead the birds into production peaks is influenced by several factors, such as, average body weight, feed formulations and quality, environmental temperature, rate of egg production, flock health and level of management. The recommended feed levels should be used as a guide and actual need should be based on the sequence of circumstances specific to the flock.

3.4 Hatching Egg Management

Optimum hatchability and chick quality can be achieved when the egg is held under optimum conditions between laying and setting in the incubator. A fertile egg contains many living cells, once laid its hatching potential can at best be maintained, not improved. If mishandled, hatching potential will quickly deteriorate. Certain ground rules of egg gathering, grading, fumigation, cooling, storage and setting should be followed as routine. Therefore:

- Keep nests clean
- Gather eggs at least 4-5 times per day
- Fumigate the hatching eggs with formaldehyde gas immediately after each collection
- Store hatching eggs in egg holding room at 60-65°F (16-18°C) and 75%-80% relative humidity and with the large end up.
- Do not let egg "sweat", either during holding, tarrying or before setting. Fluctuation in temperature and relative humidity causes sweating of eggs; warm or cool eggs slowly.
- Remove and discard eggs unsuitable for hatching – dirty, cracks, small, very large or double yolked, poor shells, or grossly misshapen.

4.0 SITE SELECTION AND HOUSING

Proper siting of Shikabrown® poultry housing is extremely important. Problems can result if poultry houses are built in unfavourable locations. When farmers are considering building poultry farms, some factors need to be put into consideration. Some of these factors are as follows:

Neighbours

The location of poultry farm should not be too close to residential/occupied homes. If the building site is too close to

occupied homes, it may bring about reaction especially when odour from the farm disturbs neighbours. Some poultry companies require prospective poultry farmers to discuss building plans with their neighbours before construction starts.

Topography

This has to do with the physical features of the area; whether the site is level, gently rolling or hilly will determine the amount of grading work that must be done to get a level area for the buildings. Low-lying areas near streams with flooding potential should be avoided. Preferably, the topography will allow the long axis of the poultry house to be located in an east-west direction. This helps to minimize the amount of direct sunlight that would enter through the sidewalls of the houses.

Prevailing wind

Prevailing wind direction must be considered when wind currents flow from the chicken house towards any residence. Odour from poultry houses must be given adequate time and distance to become weaker before reaching a residence. The distance from the poultry house location to any residence would need to be greater if prevailing winds is directed toward the residence.

Utilities

Utilities are services provided for the public. Some questions about utilities must be answered to help determine poultry building site location. Is electricity readily available or will the local electric utility run new lines at a reasonable cost? Is water available from wells or a municipal water system or both? It is important to have a backup water system. Is the quality and quantity of the well water suitable for a poultry operation?

Roads

The condition of public roads must be adequate to allow feed trucks, chick-delivery, vehicles and live-haul trucks access to the farm at all times of the year.

Future expansion

The potential building site should allow the possibility for further expansion. Often, a poultry farmer will start with few houses and will want to build additional houses at a later time. Therefore, there should be plan for future expansion.

Other buildings

The building site needs to have adequate land area available for other buildings, such as litter storage. These buildings should be out of public view if possible. The buildings need to be located close enough to the production facilities to minimize travel time, but far enough to reduce possible disease transmission. A distance of about 100 feet is reasonable.

Litter utilization

Is there sufficient land available on the farm to properly utilize the litter as fertilizer, or will some of the litter be moved offsite? A nutrient management plan will help determine if adequate land area is available for litter utilization. If there is no adequate land for this purpose, plans must be made to remove excess litter offsite.

4.1 Housing for Shikabrown® Chicks and Pullets

Brooding consist primarily of the provision of adequate heat, air, water and feed to the chicks. There are different types of structures or modifications of old structures that can be used for brooding houses. Sometimes the half-walled laying houses are covered with tarpaulin or empty feed bags and used for brooding. Whichever structure or construction is made for brooding, the following must be taken into consideration.

There must be provision for adequate ventilation, and the house it should not be water logged in addition to ensuring that it is be constructed with heat conserving materials like blocks.

4.1.1 Space requirements for Shikabrown® chicken

This is the most important basic principle in housing, as the space available determines the number and type of poultry that can be kept. Birds need adequate space for movement and exercise as well as areas to nest and roost. The minimum requirement of floor and perch space for Shikabrown® at the stage of egg laying is 3m² per bird while the perch area required by each bird is 25cm.

Hen groups are comfortable at a stocking density of up three to four birds per square meter. However, if more space is allowed, a greater variety of behaviour can be expressed. Less space creates stressed social behaviour, allowing disease vulnerability and even cannibalism, with the weaker birds being deprived of feeding or perching space - or more likely both.

Individual birds need more room for normal behaviour and adequate exercise than the very high densities currently used in commercial intensive production of both egg laying birds and broiler chickens.

4.2 Housing Equipment Requirement

A number of equipment is needed in poultry house. Some of the equipment needed in a poultry house are brooder boxes, source of heat, feeding troughs, watering troughs and litter materials. Brooder boxes: this is needed to conserve heat within a limited area. Brooder boxes can be made from wood or metal or may be improvised from thick cardboard paper or wooden boxes. Brooder boxes should be constructed with holes at the top to provide for the escape of fumes. A space

allowance of 7sq cm per chick under the brooder box is adequate.

Source of heat

Heat can be supplied through kerosene lanterns, electricity lamps and charcoal. Whatever source of heat is used for heating, care must be taken not to come in contact with chicks or litter materials. Two to three kerosene lamps placed on the floor or two 100 watts bulbs hung at about 8-10 inches above the floor is sufficient to provide heat and light for 100 chicks.

Feeding trough

Poultry feeders are either longitudinal or conical in shape. 100 chicks would require 2 4feet long or 3 circular feeder from 4 to 10 weeks of age; 3 4feet long or 3 circular feeder from 14 to 20 weeks. Feeders should be constructed with lips to minimize feed wastage and fitted with rollers at the open end to prevent chicks from jumping in and contaminating the feed with faeces.

Watering trough

Most watering trough are conical in shape. Two 4 litre capacity waters are adequate for 100 birds from day old to six weeks of age. After 6 weeks bigger drinkers should be used. In general, waterers and feeders are often constructed in two standard sizes, for chicks and for older chickens.

Litter materials

litter materials are necessary to cover the floor of the poultry house. Saw dust, chopped maize cobs or chopped dry grass can be used as litter material. Such material is meant to absorb the moisture from water spillage and chick droppings so as to help keep the house dry all the time.

Miscellaneous equipment

In addition to the list mentioned above other equipments that would be needed in the poultry house are buckets, brooms, wheelbarrow, shovels, chicken crates, water tanks, egg laying nest, egg trays, and weighing scale.

List of Equipment for 100 Shikabrown® Birds on Deep Litter

Feeders and waterers

- 3 chick feeders (2inch feeding space/bird; 3inch deep)
- 3 chick drinkers (2 liter capacity)
- 2 chicken feeders (4 inch of feeding space per bird; 6 inch deep)
- 2 chicken drinkers (8-10 litter capacity)
- One 200 liter capacity water tank
- One feed scoops
- 2 buckets
- One roll of twine for hanging feeders

Brooding equipment

- 1 brooder box
- 3 kerosine lamps or 3 100watt bulbs
- ¼ of a roll of plastic sheet (for open sided houses only)

Equipment for cleaning and manure handling

- 1 broom,1 shovel
- 1 wheelbarrow
- 1 laying nest (20 cells)
- 6 egg trays
- Plastic bags for marketing eggs
- 1 weighing scale
- 4 chicken crates
- Record books
- Jute sack loads of litter material

5.0 NUTRITION, FEEDS AND FEEDING FOR SHIKABROWN®

Poultry have a simple digestive tract. Their feed is composed of a number of nutrients essential for their health, maintenance, egg and feather production. The main nutrients required by poultry are protein, energy (carbohydrates and fats), vitamins, minerals and water. Chicken nutrition and feeding are important parts of production. Feeds make up the major cost of production. Good nutrition is instantly noticed in the bird's performance in terms of outstanding level of egg production.

5.1 Nutrient Requirements for Shikabrown® Chickens

Understanding the nutrient requirement of a particular species or class of poultry is essential. The recommended nutrients required for Shikabrown® by different class or species of poultry are shown in Table 1. Pullet chicks are usually fed a starter diet containing 20% protein up to 8 weeks of age. This is followed by a 16% protein grower diet fed up to 20 weeks of age. Energy at starter phase is generally higher (2700 kcal/kg) than in grower (2650 kcal/kg) and laying stage (2600 kcal/kg). The lower crude protein and energy of the growers' diet compared to that of chick diets is a deliberate attempt to slow down their growth and also to avoid fat deposition. At the onset of sexual maturity which is defined as the age at first egg (approximately 18-20 weeks in many strains), a layer ration containing an adequate level of calcium as well as other nutrients need to be made available to the birds.

TABLE 3: RECOMMENDED NUTRIENT LEVELS

Nutrient	TYPE OF RATION			
	Chick (0-8wks)	Grower (8-20wks)	Layer (20-72wks)	Breeder (20-72wks)
Energy kcal/kg	2650	2650	2650	2699
Crude protein, %	20	15.5	16.5	17.50
Calcium %	1.25	1.0	3.25	3.25
Phosphorus (Total)%	0.85	0.7	1.00	1.00
Lysine %	1.00	0.80	0.80	0.80
Methionine + Lysine %	0.40	0.5	0.50	0.50
Tryptophan %	5.00	4.0	3.00	3.00
Crude fat %	0.17	0.14	0.14	0.14
Riboflavin (Vit B ₁₂), mg.kg	5.00	5.00	5.00	5.00
Choline, Mg/kg	1000	1000	1200	1200
Vit. A (I.U/kg)	4000	4000	8000	10000
Vit D ₃ (I.U/kg)	6.00	2000	2000	2000
Vit E (I.U/kg)	5.00	3.0	3.00	3.0

6.0 HEALTH CARE MANAGEMENT FOR SHIKABROWN® CHICKEN

The anticipated performance objectives from the Shikabrown® chickens pre-suppose that diseases and other management problems will not hinder the full expression of the production capabilities of the chickens. Diseases are a common cause of losses in poultry enterprise, both in terms of mortalities and reduced performance of surviving chickens. Thus, maintenance of flock health is one of the pre-requisites for profitable poultry operation. The ‘rule of thumb’ is prevention rather than cure, and constant vigilance is the price for success in poultry management.

Most of the economically important diseases of poultry are infectious and contagious, and are therefore readily transmitted from one individual to another. Thus, if a poultry man is to derive maximum benefits from his chickens, he must assume the role of a health officer for his stock. He must plan and carry out a programme of flock management that will give the chickens optimum environment required to achieve the performance objectives. Adoption of the following practices and routine vaccination/medication program is therefore highly recommended for best performance from your Shikabrown®.

Suggested management tips to prevent and minimize disease outbreak.

- Poultry houses and equipment should be thoroughly cleaned and disinfected before the arrival of chicks.
- “All-in” and “all-out” system should be practiced
- Do not mix birds of different ages.
- Avoid overcrowding by providing optimum floor or cage space.
- Keep the litter dry and the houses well ventilated.

- Vaccinate your chickens against the major economic diseases.

Also, routine preventive medication at specific intervals (depending on location) should be administered to protect the chickens against some parasitic and protozoan infections. The details of such routine vaccination/medication program with respect to some of the important poultry diseases are described in the section below.

6.1 Farm Management Practices to Reduce Disease Risk

Farm management practices are the general principles for disease prevention and efficient productivity in the stock. Hygiene on the other hand is the functional (day to day or periodic) component of farm management for achieving efficiency in disease control. The challenges caused by diseases are particularly formidable when birds are housed under intensive conditions with birds in close proximity to each other especially in the modern poultry. This encourages maximum spread of diseases from one bird to another. Meanwhile, it should be noted that even under extensive conditions diseases can easily spread among birds because they are normally housed close together at night in order to protect them from thieves and carnivorous animals. The following are important hygiene and farm management steps to ensure that disease attack and spread are minimized:

a) Consultation

Often, poultry farmers who experience serious disease problems are those who fail to consult with the professionals whose opinions and advice are cogent. These professionals are:

- ▲ The poultry extension specialist.
- ▲ The veterinarian.

▲ The Agricultural extension agents

Consultation with these specialists will prevent some of the common pitfalls in poultry business. The consultation should be done at the planning stage. The specialists will advise on various management practices to prevent diseases. These include the following:

1. Choosing a favourable geographical location to site the farm putting into consideration the production objectives.
2. Building design which involves the orientation of poultry buildings, spacing, animal comfort, ease of cleaning.
3. The types of feed for each category and mode of feeding.
4. The types of litter material available for use in deep litter house, depth of litter, litter hygiene and disposal.
5. Brooding of chicks and ventilation for adult stock
6. The control of vermins.
7. The control of human traffic both staff and visitors, and hygiene of staff.
8. Culling operations.
9. How to handle disease outbreaks, early detection of diseases, veterinary services available, cleaning out.
10. How to eliminate stress factors by following high standards management and hygienic practices.

b) Sources of chicks

The source of chicks is an important aspect of management if you do not hatch eggs on your farm. Chicks and preferably day-old should be purchased from a reputable hatchery or a proven source. Many poultry diseases originate from the hatcheries while some are transmitted from the hen to the chicks through the egg. A good hatchery must therefore maintain a high level of sanitation to prevent chicks becoming infected.

c) Rearing of poultry

The birds should be reared in separate houses according to their age groups and species. If birds of different ages and of different species are housed together, the spread of disease is encouraged. If birds of one age only are kept on one site there is lesser chance of disease spreading from older birds to the younger ones. This can be achieved if the poultry breeder follows the all-in/all out system. In this system, whether egg type or meat-type, all the birds are brought onto the site at the same time and same age. At the end of the production period, all birds are removed, the manure is cleaned out, the houses thoroughly disinfected and a gap of at least two weeks is left between the selling of one batch of birds and the replacement with a new batch.

d) Brooding

Brooding is the care of baby chicks During the period, supplementary heat is provided for the comfort of the birds. Duration of brooding has already been discussed. Proper brooding is very important in preventing disease in chicks and minimizing loss.

e) Ventilation

In tropical climate, heat stress is probably the most important factor to contend with in poultry house designs. Poultry houses should be designed to provide adequate ventilation prevent excess dust and wet litter which can lead to ammonia build-up. Improper ventilation may cause wet-litter which in turn promotes development of coccidial oocyst. Coccidiosis is a very common disease of poultry especially when they are raised on deep litter system. Coccidial oocyst requires moisture to develop into the infective stage. Proper ventilation promotes dry litter and therefore inhibits the

development of coccidial oocyst, thus preventing coccidiosis. Poor ventilation on the other hand promotes rapid spread of poultry diseases especially those that can easily spread from bird to bird through the air.

f) **Restriction**

Non-workers in the farm should be restricted from entering the flock house. This is a good way of preventing introduction of diseases from outside to the farm. Where it is necessary to allow visitors on the farm, proper sanitary precautions must be taken to ensure they do not bring in disease to the flock. Vehicles and poultry equipment that have been used elsewhere are other ways by which diseases can be introduced into your farm. Such equipment and vehicles should be disinfected properly before use on the farm. Provide footbath containing a disinfectant at the entrance to each pen house. Prepare fresh disinfectant daily.

g) **Feeds and Feeding**

Adequate feeding together with other management steps is very essential for maintenance of flock health and productivity. Correct feeding is required for normal growth, vigour, egg production, hatchability and long productive life. Poultry feed rations are formulated to contain all the nutrients essential for the proper functioning of the body in right quantities. Deficiencies of any of these essential nutrients often cause disease conditions. Water is the cheapest of all the feed nutrients and the supply must be tested for quality to make it safe for poultry. Poultry feeds should be purchased from a reputable feed manufacturer. It is good to seek for advice from more experienced farmers

in your locality. A good feed kept for too long in the store may lose some of its essential nutrients. Also, the use of mouldy feeds results in aspergillosis or brooder pneumonia. Many poultry diseases can be spread through the faeces containing the feeders and waters. Therefore, feeders and waters must be designed in a way that prevents faecal contamination.

h) **Post-mortem examination**

Even with the best management, occasional loss of poultry is experienced from known and unknown causes. Efforts should be made to find out the cause of death even with a loss of one bird with a view of preventing recurrence. One way of determining the cause of death is post-mortem examination which veterinary services will provide. Whenever a bird is found dead, it should be removed at once for examination before it is disposed off. Freshly killed or dead animal is the most suitable for a post-mortem examination but if veterinary services are not readily available, then the dead bird can be kept in a refrigerator for some days. The veterinary doctor based on his findings will then give professional advices on the steps to take to prevent future occurrence.

i) **Record keeping**

Record keeping is very important; it gives the required warning of an impending problem. Most disease problems are reflected in the feeding pattern of the birds. A drop in feed consumption is usually one of the first signs exhibited by a sick bird. There are three types of record that all poultry farmers should keep, namely:

1. Inventory record
2. Production record
3. Financial record

Among these three, production record is the one that relates very closely to poultry health management.

j) **Disposal of dead birds**

One way of preventing the spread of disease from dead birds is by proper disposal of the dead ones. For this reason, dead birds must be buried or burnt immediately. Vermin may serve as carriers of disease germs after contacting diseased or dead birds. The essential management procedures to minimize or prevent the spread of diseases from dead birds are as follows:

1. Immediate removal of all dead birds from cages, floor pens.
2. Keeping the waste bin for holding dead birds closed always to prevent contact by flies, dogs, insects, etc.
3. The waste bins should be well isolated from the operational areas.
4. After handling a dead bird, all equipment, and materials used should be disinfected.

Methods of disposal vary and a farmer should adopt whichever method he considers suitable for his needs. The common methods are:

1. **Incineration:** This involves burning of the carcasses completely until ash is formed. The incinerator is the place where the burning is done.
2. **The disposal pit:** This uses continuous bacterial action to break down the soft tissues as dead birds are added. Pits are constructed in the ground to deposit dead birds.

3. **Rendering:** This helps to recycle dead birds by converting dead carcasses into animal by-product and feed.

4. **Acid hydrolysis:** This uses phosphoric acid, water and heat to convert indigestible animal tissues into a high-protein feed supplement. Carcasses are ground and then hydrolysed by the acid and blended directly into a feed formulation. The hydrolysis plant is expensive and is not for small scale poultry operation.

Other Important Management Steps

1. Stock the house bearing in mind the feeding and drinking space, and bird space requirement. The stocking density or ratio must not be ignored.
2. Keep vermin out of the poultry house-since these have been shown to have the capacity to introduce microorganisms into poultry house.
3. Feed troughs and water troughs should be cleaned out daily and refilled with fresh feed and fresh and cool drinking water. Stale feed and water are veritable media for the growth of microorganisms.
4. Make use of veterinary services before medication and vaccination administration for proper guidance and effectiveness.
5. Sick birds should be isolated promptly from the flock. The farmer should not hesitate to destroy them by burying them or burning them in an incinerator. To be able to detect sick birds, the farmer must observe the flock at regular intervals.

6.2 Biosecurity

Biosecurity is a way to avoid contact between animals, people, and microbes. The aim of hygiene and biosecurity is to prevent infectious diseases, and mortality and financial losses caused by infections. This is done by:

- Reducing the number of microbes in and around chicken houses and runs by cleaning and disinfecting houses and equipment
- Taking measures to keep pathogens away from farms and chicken houses.

The more birds you have, the more attention you should pay to hygiene and biosecurity, as losses from infectious diseases can be very high. Note that, although most microbes can be killed with disinfectants, these substances are not intended for use on animals, whether externally or internally.

6.2.1 Biosecurity measures in Shikabrown® chicken houses

- i. When starting a poultry farm, keep a distance from other poultry farms or houses. Note the direction the wind normally comes from and if possible locate your farm where the prevailing wind will reach your farm first before others, especially in the dry season.
- ii. Keep scavenging chickens or ducks (local poultry) away from your commercial poultry flock, as they can introduce new germs. Do not allow any visitors in your chicken houses. Make sure that persons entering poultry houses change their footwear, and make available a footbath in front of each poultry house.
- iii. Humans, wild birds, vermin: they all visit other places as well. Make sure your houses, feed storage and water tanks are bird-proof.
- iv. Beware of used egg trays. You may not know where they come from.
- v. Sale chickens, eggs, or old litter outside your farm or at the farm-gate.
- vi. Keep different species of birds apart. Keep birds of different ages apart. On a farm with birds of different

- ages, always go from the younger and weaker birds to the older ones and not from the old to the young birds.
- vii. Only keep birds of one age at one time in each poultry house. After each batch, clean and disinfect all the houses. This is the ‘all-in all-out principle’.
- viii. Keep chicken houses dry and clean; keep the area around houses clean too, as rubbish attracts rats and wild birds to your poultry house.
- ix. Footbath containing a disinfectant should be provided at the entrance to each pen house and the poultry farm. Prepare fresh disinfectant daily.
- x. Clean drinkers and feeders regularly, making sure that drinker do not overflow. Provide clean drinking water that is not from a pond, to prevent outbreaks of water-borne diseases like fowl cholera.
- xi. Always keep litter dry. Renew litter regularly, and never store old litter near chicken houses. Keep stocking density down, as infected animals excrete many microbes and disease can spread rapidly.

6.2.2 Prophylaxis

This is the prevention of a disease. It has been found that the most careful observance of good farm management and hygiene practices may not be full-proof in the prevention of diseases. Occasions for additional efforts will arise. However such occasions can be greatly minimized by the use of preventive medication and vaccines. It is important to know why and when to employ preventive medication and vaccines. For instance:

1. When it is known that certain diseases are endemic in an area and therefore pose a threat which can only be handled by preventive medication and or vaccination e.g. Newcastle disease, fowl pox, Gumboro disease, Marek’s Coccidiosis

2. When unfavourable climatic changes are likely to precipitate a disease condition like coryza in poultry
3. When stock density or litter management problems raise the possibility of disease outbreak like coccidiosis.

In these and other instances, vaccines or drugs can be strategically applied to pre-empt disease outbreak. Disease outbreak cannot be predicted, therefore, routine vaccination and medication practices in farm animals including poultry are important.

The vaccines or coccidiostats are applied when the disease has not appeared in stock. Hence, defensive mechanisms are introduced through the development of antibodies in the one case and the destruction of the early stages of the disease agent (coccidia) in the other. Different coccidiostats should not be mixed since it may be harmful. Coccidiostats should be mixed in the food but should be withdrawn four days before the birds are slaughtered so that it does not find its way through poultry meat into the consumer system. Amprolium is a potent coccidiostat to treat birds when an outbreak of coccidiosis occurs in a flock.

Vaccination

As some viruses can spread by air, hygiene and biosecurity measures will often not be sufficient to prevent infection. Vaccination is therefore very important for preventing infectious diseases, especially viral diseases. Vaccines can be given in many ways, via drinking water, injection, eye drops, spray, etc. Such vaccines provide rapid protection, taking effect within a few days.

Vaccines are temperature sensitive, so they should never be kept without refrigeration. Once dissolved, they should be used within few minutes/hours.

Buying and storing vaccines

Recommendations with regard to the purchase and storage of vaccines for chickens:

1. Buy vaccines from a reliable, specialized firm or veterinarian selling relatively large quantities of vaccines
 - Check type of vaccine, dose, date of expiry
 - Check the sealing; vaccine becomes rapidly inactive in damaged bottles and ampoules which have lost their vacuum.
2. When buying a vaccine, bring an ice-box along and take the vaccine home as quickly as possible.
3. It is essential to have a reliable refrigerator
 - ▲ Large farms need two refrigerators and a stand-by electricity generator in case of power failure
 - ▲ Maintain the refrigerator properly and check ice formation regularly.
 - ▲ The temperature inside the refrigerator should be as stable as possible, between 2 and 6°C
 - ▲ Do not put vaccines in the freezing compartment.

Procedure for drinking water vaccination

Materials needed are the vaccine, drinkers, skim milk-powder, measuring equipment, a mixing vessel and stirrer. All the equipment should be very clean and absolutely free of disinfectants and detergents by rinsing several times with clean water.

Sequence of activities is as follows:

1. Read the instructions accompanying the vaccine and check the type of vaccine, the number of doses and the date of expiry.
2. A few days before the vaccination, add extra plastic drinkers so that all birds can drink at the same time and the birds get accustomed to them. On the last few days before vaccination, no drugs, disinfectants, or detergents should be used.
3. Only good quality, cool water should be used:
 - ▲ Free of heavy metals, chlorine, less than 50 mg NO₃/liter, no NO₂
 - ▲ Good quality public tap water without chlorine can be used; rainwater can also be used
 - ▲ Boiling the water is a good practice; the water should be quickly cooled down afterwards.

It is safe and preferable to add milk-protein for the protection of the vaccine virus/bacteria:

- ▲ Most common is to use 2g skim milk-powder per litre of water
- ▲ It is also possible to use 20ml pasteurized or sterilized skim milk or whole milk or 20ml of boiled fresh milk/litre of water
- ▲ Using more milk than the above-mentioned minimum quantities is all-right up to a maximum of 50% milk or 50g skim milk-powder per litre of water

4. The best time for vaccination is at a cool period of the day; this is the (early) morning. The time is also ideal to get cool water and again maintain the coolness.
5. At the time of vaccination, all the birds should be made to be a bit thirsty. To achieve this:
 - ▲ Supply no water for some hours prior to vaccination; laying birds and young chicks for not long period, rearing birds can be overnight. The aim is to get a rapid water consumption, by all birds
6. The drinkers should be clean thoroughly with brush and clean water just before vaccination. The drinkers should not be exposed to sunlight (in order to keep the temperature down).
7. Measure and prepare the water and measure the milk-product:
 - ▲ To protect the vaccine, the milk powder has to be added to the water before the vaccine
8. Mix the vaccine properly with the water, just before giving the water to the birds:
 - ▲ The best thing to do is to mix first with a small quantity of cool water in a smoothly-walled calibrated vessel and then to put (or to distribute) this mixture in a measured amount of water in the drinkers whilst stirring well

9. Immediately after mixing, the vaccine is distributed to the chickens

- ▲ Work rapidly
- ▲ Start the distribution of the vaccine water at different places in the house
- ▲ Give no additional drinking water before all the vaccine water is finished
- ▲ Remove all the drinkers after 30 minutes to 1 hour, even if the vaccine water is not finished. Wash and refill drinkers with fresh cool water.

10. The cleaning-up phase:

- ▲ Pack and burn disposable objects or sterilize by boiling or disinfection
- ▲ Disinfect and then clean all equipment (and the hands)

11. Records:

- ▲ Date of vaccination
- ▲ Name of product, brand, batch number
- ▲ Number of doses
- ▲ Number of birds vaccinated

Table 4: Vaccination Schedule for Poultry

Age	Type of Vaccine	Disease	Route
1 day	Newcastle disease Vaccine (1 st dose)	Newcastle disease	Intra ocular (1/0)
2 weeks	Gumboro disease Vaccine (1 st dose)	Gumboro	Oral,
3 weeks	Newcastle disease Vaccine-lasota (2 nd dose)	Newcastle disease	Oral,
5 weeks	Gumboro disease Vaccine (2 nd dose)	Gumboro/IBD	Oral,
6-8 weeks	Fowl pox Vaccine	Fowl pox	Wing web stab
7-8 weeks	Fowl typhoid/fowl Cholera vaccine	Fowl typhoid/fowl cholera	Subcutaneously (sc)
16-18 weeks	Newcastle disease komorov (3 rd dose)	Newcastle disease	i/m
30 weeks	Newcastle disease Vaccine-lasota (Buster Dose)	Newcastle disease	Oral

7.0 EGG PRODUCT PROCESSING, PACKAGING AND PRESERVATION

The Nigerian Shika Brown is an egg laying chicken producing an average of 280-300 eggs within its production cycle. This bird may be reared in a deep litter system or in a battery cage unit depending on the farmer. Most large scale producers prefer the battery cage unit because, egg production per bird can be monitored and the eggs produced in this unit is usually cleaner than those of the deep litter system.

7.1 Egg Handling and Storage

To obtain good quality eggs from the flock, farmers should try to properly handle the eggs. Egg management should be maintained from the point of production through to marketing. Production of good quality eggs can be actualized through the following practices:

1. Healthy layer management
2. Early and frequent collection of eggs
3. Egg hygiene and handling

7.2 Early and Frequent Collection of Eggs

Eggs from the Shikabrown[®] chicken should be collected at least three times in a day, at 8am, 12 pm and 4pm. The frequency of collection will prevent eggs from getting dirty and broken. Eggs should be collected in clean containers, preferably plastic basins, farmers should avoid the use of metal containers which are liable to rust. Upon collection, eggs should not be stacked too high to prevent breakage.

7.3 Egg Hygiene and Handling

Eggs can be washed in warm water at 43 to 48°C for 3 minutes. The water should contain detergent –sanitizer like 5% quaternary ammonium compound which kills bacteria on the shell. Eggs should be immediately after collection, to remove dirt and stains on the shells, extremely dirty eggs should be washed separately. For large scale commercial egg producers, egg washing machines could be used for this operation.

Egg Polishing

After washing, air dry the eggs for about 18 hours before polishing with oil, such oil includes; linseed oil or sunflower oil. Polishing could be carried out with the aid of a hand spray or knapsack, clean eggs should be sprayed with the large end up and the small end down. The spray or mist should cover about $\frac{3}{4}$ of the large end of the egg. The spray should be odourless, colourless, tasteless and low in acid content.

7.4 Egg Packaging and Storage

In the tropics, eggs can deteriorate very quickly unless they are stored at low temperatures. The ideal temperatures for storage in such climates are 13°C or lower (usually between 10° and 13° C). Here a cold room or a refrigeration is a necessity for successful commercial egg storage; however, it may be unavailable or the costs too high.

The most important factors in successful cold storage are as follows.

- The selection and packaging of eggs.
- The equipment and preparation of the cold store.
- Proper temperature, humidity and air circulation.
- Periodic testing for quality.

- The gradual adjustment of eggs to higher temperatures when removed from storage.

Eggs for storage must be clean, of good interior quality and have a sound shell, if they are to be stored for more than a month. Therefore, it is best to candle all eggs before storage. It may also be advisable to take a sample and to break out these eggs as a further quality check. The period of time between laying and storage should not be more than a few days. The eggs should be kept cool during that time.

Packaging is an important component in delivering quality eggs to buyers. It embraces both the art and science of preparing products for storage, transport and eventually sale. Packaging protects the eggs from:

- Micro-organisms, such as bacteria;
- Natural predators
- Loss of moisture
- Temperatures that cause deterioration and
- Possible crushing while being handled, stored or transported

Egg packaging and packaging equipment should be designed, constructed, maintained and used in a manner that will minimize damage to the egg-shell and avoid the introduction of contaminants in or on eggs.

Any egg packaging, storage or associated equipment should not transfer substances to eggs that will cause a health risk to the consumer. Where permanent equipment is used, it should be corrosion resistant and easy to clean and disinfect or if necessary able to be dismantled and reassembled.

7.5 Egg Transportation

Whenever eggs are transported, it should be in a manner that minimizes damage to the egg or eggshell and avoids the introduction of contaminants in or on eggs. Personnel and vehicular access should be adequate for the hygienic handling of eggs, such that contamination is not introduced onto the farm and thus in or on eggs.

Lorries, trucks or other vehicles or equipment, which carry the eggs, should be cleaned at a frequency necessary to prevent contamination flow between farms or premises and thus of eggs. The time and temperature conditions for the transport and delivery of eggs from the producer should be established taking into account the hygienic condition of the eggs, the hazards that are reasonably likely to occur, the end use of the eggs, and the intended duration of storage.

7.6 Egg Marketing

Availability and proximity to the market is very important in the egg production business. It is advisable that the farmers should have sought for a ready market before venturing into the enterprise.

Also, it is important that the eggs reach the consumers in the form, place and time desired. Farmers may decide to market their produce directly to consumers through:

- Sales from the farm (farm gate)
- Forming Cooperatives with other farmers who collectively sell their eggs to wholesalers
- Sales to local retail shops.

The main advantage of farm-gate selling is that the producer may be able to obtain a market price for eggs

without incurring market costs. On the part of the consumer, the advantage is that eggs will be fresh with little or no quality loss.

7.7 Egg Product Processing

Eggs for processing must be of high quality to avoid excessive yolk breakage in egg-breaking machines. A fresh egg will have a thick white and an upstanding yolk. Over time, the egg white thins, and the yolk spreads and enlarges due to passage of water from the white through the yolk membrane into the yolk. This weakens the yolk. Eggs to be processed are usually held in refrigerated storage no longer than seven to ten days. Some of the processing methods includes:

Pasteurization

Essentially all egg products are pasteurized by heating the liquid to a lethal temperature below that of coagulation, holding for a period of time to kill vegetative cells and then cooled for packaging. This destroys Salmonellae, but it does not cook the eggs or affect their colour, flavour, nutritional value or use. Dried whites are pasteurized by heating in the dried form. Each egg product, based on composition, has specific minimum temperature and minimum-holding time established and recognized by health authorities as being adequate for reducing the risk of salmonella. Liquid egg products yolk and whole egg are pasteurized by plate pasteurizers, which have a relatively large heat stable compartment since the pasteurization temperature of egg products cannot be very high. Liquid egg white is pasteurized when sold as a liquid or frozen product

Dried egg products can be heat treated by a so called “hot room” treatment at 130°F (54°C) for 7 days. Here the products are in their final package already. Disadvantage of this treatment is the long time, which requires a lot of room for the products.

Bactofuge treatment

It is a hyper filter method, where bacteria, yeasts and fungi are removed from the products. Disadvantage of this treatment is the high pressure needed and the small opening of the filters, which can damage the product properties. This may also happen when products are decontaminated by ultra high pressure.

Drying

Whole egg and egg yolk are dried by the spray-drying process. The liquid is channeled into a chamber where a flow of heated air evaporates water leaving the solids to be collected, sifted and packaged for storage and distribution. The water content after drying is in the range of 3 to 5% for a stable product.

Egg whites for drying must have the natural glucose (sugar) removed usually by fermentation to prevent adverse changes in storage. The fermentation may be accomplished by selected bacteria, yeast, or by enzymes. Egg white is usually spray-dried to about 6 to 8 percent water content. Egg white is also pan-dried by simply placing the fermented liquid in shallow trays where water evaporates leaving large crystals of dried egg white solids. Pan-dried egg white is ground to a fine powder for packaging. Before drying a large part of water can be withdrawn by ultra filtration.

Dried egg products

Dried egg products are usually produced by spray drying, although some egg white is dried on trays to produce a flake or granular form.

Before the egg white is dried, glucose is removed. This produces dried egg white products with excellent storage stability. Whipping aids may be added to produce dried egg white products for good whipping properties. Sodium lauryl sulphate, an angel food cake volume enhancer, is added at a level of less than 0.1% by weight of the liquid prior to drying.

Whenever long storage stability is required, glucose is removed from whole egg and yolk products before drying. Non-reducing carbohydrates such as glucose-free corn syrup and sucrose are added to some products to preserve their whipping properties and to improve their storage stability.

Egg White Solids

As long as they are kept dry, egg white solids are stable during storage even at room temperature. Spray-dried egg white with glucose removed has an almost infinite shelf life.

Dried Whole Egg and Yolk Solids

This should be kept cool, less than 50°F (10°C), to maintain quality. Once containers of egg solids have been opened, they should be resealed tightly to prevent contamination and absorption of moisture. If dried eggs are combined with dry ingredients and held for storage, they should be sealed tightly in a closed container and stored in the refrigerator at 32° to 50°F (0° to 10°C). Reconstituted eggs should be used immediately.

EGG/EGG PRODUCTS MARKETING AND TRANSPORTATION

Marketing of Poultry

The marketing of poultry products is an important function of the poultry industry as it plays a major role in transferring products from the poultry farm to the final consumer. Marketing is a complex activity which commences with the poultry farmer's decisions on how to dispose of his produce, through the activities of intermediaries including product, assembling, transportation, storage, processing, packaging, wholesaling, retailing and ownership by the final consumer. Developing marketing strategies based on product, pricing, distribution and market information decisions is another important marketing activity. Many factors will therefore determine the quantities and quality of the poultry product. Of great importance could be the price received at various levels of the marketing process. At the poultry farm level for example, input and output prices will be determining factors, while at the intermediary level determining factors could be market conduct, structure and performance. At the consumer level-determining factors will include product price, incomes, substitutes etc

Marketing:

It is a general term used to describe all the activities that lead to final sales of poultry products. It is the process of planning and executing pricing, promotion and distribution to satisfy individual and organizational poultry needs in order to accomplish the poultry producers' objectives. From this definition it is easy to see that marketing in poultry business is more than just the process of selling a poultry product. A basic knowledge on marketing process in poultry business is an

essential component, and without proper marketing idea, even the best poultry producers may receive less or even no profit. Therefore, marketing activities bridge the gap between the poultry production and consumption. This is shown schematically as:

Production → Marketing → Consumption

A poultry farm manager must have a basic knowledge of what is happening in the poultry marketplace in order to meet its customer's needs. Such information on the market demand and supply, prices and the unexploited market shares and possibility of taking forward steps along the value chain for value addition to enhance profit and developing strategies and techniques to maintain and retain the market shares should be properly used by farmers to adequately plan the poultry business.

In summary, the poultry farm manager should have market information on market and marketing for proper decision making on the following four (4) P's:

- Product
- Place/Distribution
- Promotion
- Pricing

Poultry Meat and Eggs Quality Grading, Certification, and Verification

Chickens, turkeys, ducks, geese, guineas, pigeons, and shell eggs are all eligible for grading, certification, and auditing services. Different actors along the poultry value chain have standards for poultry products grading activities to ensure that

their requirements for quality, weight, condition, and other factors are met.

Poultry Marketing Standards

The sale of poultry meat and eggs for human consumption must be in accordance with marketing standards legislation. Usually, such regulations facilitate harmonised standards throughout the poultry products markets in terms of:

- i. the hygiene requirements for poultry products marketing,
- ii. the food labeling indicating expiring date, temperature control, packaging materials and weights.

Poultry must be marketed in one of the following conditions (FAO, 2008):

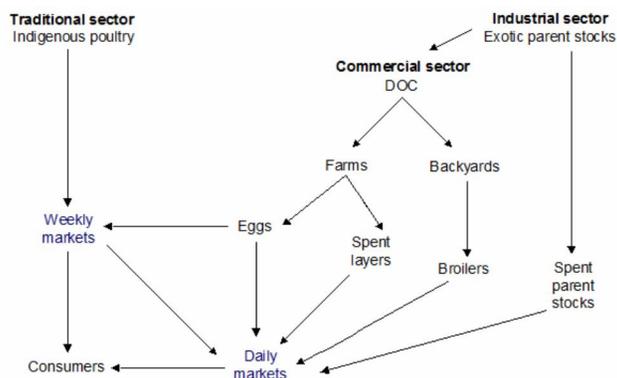
- Fresh poultry meat: This is defined as poultry meat not stiffened by the cooling process, which is to be kept at a temperature not below -2°C and not higher than 4°C at any time.
- Frozen poultry meat: This is defined as poultry meat which must be frozen as soon as possible within the constraints of normal slaughtering procedures and kept at a temperature no higher than -12°C at any time. The temperature must be stable and maintained at -12°C or lower,
- Quick-frozen poultry meat: This is defined as poultry meat kept at a temperature no higher than -18°C at any time, and
- Non-floating eggs when immerse in water.

The Distribution Chain of poultry and poultry products

The distribution chain of poultry products begins at the farm level to the final consumer. A farmer or an actor who wants to add value or utility to the poultry product in order to maximize profit should have a basic idea on movement channel of the poultry products. Usually farmers receive relatively low prices from poultry products sold at farm gate to buyers while those sold at markets or directly to processors gain higher profit. Most of the times, group marketing of the poultry products helps to increase bargaining power of the farmers and reduces marketing costs which will automatically lead to enhanced profit.

The overall objective of marketing in poultry is to supply buyers and consumers with poultry products to meet market demand in different periods of the year. Below is a distribution chain of poultry products marketing in Nigeria.

Nigerian poultry market chain



Source: Adapted from FAO, 2008

A poultry [distribution channel](#) can be as short as being direct from the vendor to the consumer or may include several interconnected [intermediaries](#) such as [wholesalers](#), [distributors](#), [agents](#), [retailers](#). Each intermediary [receives](#) the item at one pricing point and moves it to the next higher pricing point until it reaches the final [buyer](#). During festive occasions (Christmas, New Year, Easter, end of Ramadan), there is a peak in demand for poultry meat and eggs.

Types of Poultry Markets

Basically, there are two types of poultry markets in Nigeria

1. Weekly poultry markets
2. Daily poultry markets

Weekly poultry markets

These are poultry markets that mostly work on weekly basis and have relatively non-permanent structures. In this type of markets, there are different poultry products mediators, referred to as:

- Collectors - persons who buy poultry directly from small rural and urban producers, at home or at the market.
- Middlemen - persons who buy poultry from collectors or other middlemen.

Weekly poultry markets have three basic functions:

- (i) as places where rural, small-scale and backyard producers sell their products.
- (ii) as drainage of local and some exotic poultry products for other markets.
- (iii) as normal markets, where the final consumer can buy poultry for his/her own consumption, for home rearing and/or for sacrifices.

Weekly poultry markets are mainly located in rural and semi-urban areas, where they drain products from the surrounding areas. Only a small portion of the poultry comes from the industrial sector or from far away.



Typical examples of Weekly poultry market

Daily poultry markets

These are poultry products markets that operate on a daily basis, usually characterize by more permanent structures. Daily poultry markets have two basic functions:

- i. to offer urban and semi-urban consumers the possibility to buy products for their own consumption, for family rearing and/or for sacrifices
- ii. to act as the main markets for the sales of commercial producers

As their name implies, the daily markets work on a daily basis, with only a few partially closing during major festivities. They are located in urban and semi-urban areas and receive poultry from the surrounding weekly markets, from the larger poultry industry. The place of origin of the products may be either close or distant.



Typical Examples of Daily Market



Downloading of spent parent stock in daily poultry market in Onitsha town

In the daily markets, the poultry sector is active all year round as long as there is daylight. Retailers are mainly the small merchants seen in the weekly markets.



Summary of Routine Management practices

1. In the first week, inspect your birds as early as possible in the mornings, as late as possible in the evenings and occasionally at other times to be sure the chicks are comfortable.
2. Remove any dead birds and dispose properly by burial or disposal pit.
3. Remove moldy or contaminated feed and add fresh supply. Feeders should only be $\frac{1}{2}$ full to avoid feed wastage
4. Remove the drinkers and wash properly before refilling with fresh clean water. Drinkers may be raised on block to minimize contamination
5. Remove the wet litter material and replace with dry one
6. Be very careful with lanterns to avoid fire out-breaks and excessive smoking.
7. Keep accurate record daily.