

Poultry Production (Provide Feeds and Implement Feeding Practices) Module 2

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We value your feedback and recommendations.

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MODULE 2: PROVIDE FEEDS AND IMPLEMENT FEEDING PRACTICES

I. INTRODUCTION

This Module covers the knowledge, skills, and attitudes required in efficient and effective feeds and feeding management of chicken. This Module will also serve as a means of developing learners who have the potential in feeds and feeding management of chicken.

II. LEARNING COMPETENCIES

Upon completion of this Module, you should be able to:

1. feed birds properly;
2. enumerate the essential nutrients needed by chicken;
3. differentiate the kinds of feeds appropriate to chicken at different stages of growth and productive; and
4. identify/classify feed ingredients commonly used in formulating layer and broiler ration.

III. DIAGNOSTIC/ PRE-ASSESSMENT

Let's find out how much you already know about feeding broilers. Answer the following questions honestly. Write only the letter of the correct answer in your activity notebook.

1. The greatest percentage of expenses incurred in broiler production is the cost of_____.
a. antibiotics b. chicks c. feeds d. labor
2. Birds are fed for the purpose of supplying nutrients needed for their_____.
a. growth and development
b. life maintenance
c. reproduction
d. reproduction, life maintenance, growth and development
3. Which of the following reasons below is the primary function of feeds?
a. For fattening c. For reproduction of their kind
b. For growth and development d. For maintenance of life
4. For maximum efficiency, nutrients have to be supplied with the_____.
a. balanced ration c. right quantity of ration
b. right quality of ration d. right quantity and quality of balanced ration

5. Nutrients are supplied through the feeds which provide the birds with the needed_____.
- energy
 - protein
 - fat
 - vitamins
6. Which of the choices below constitute the largest portion of poultry feeds?
- Carbohydrates
 - Fats and ash
 - Protein
 - Vitamins
7. Which statement below best describes a yellow corn?
- High in fiber but contains an adequate amount of fats
 - One of the best grains in fattening chickens
 - The cheapest source of carbohydrates
 - The common and cheapest source of plant protein
8. Which is NOT a function of water?
- Acts as food carrier
 - Acts as tissue lubricant
 - Aids in digestion and absorption
 - Supplies the animal's body with energy
9. The kind of broiler/diet which has the highest protein content is_____.
- chick booster
 - chick starter
 - finisher feeds
 - grower feeds
10. Which of the following is NOT beneficially influenced by antibiotics?
- Feed conversion
 - Rate of growth
 - Reduction of mortality
 - Repair of broken tissues

11. Listed below are rations/diets for layers EXCEPT____.
- a. booster
 - b. grower
 - c. finisher
 - d. starter
12. Listed below are diets/ration for broiler EXCEPT____.
- a. developer
 - b. finisher
 - c. grower
 - d. starter
13. Which form of feeds is made from crushed pellet?
- a. Crumble b. Grits c. Mash d. Pellet
14. Feeds given during the early stages of growth should have a protein content of_____.
- a. 16-18 %
 - b. 19-21 %
 - c. 22-24 %
 - d. 25-27 %
15. The daily average amount of feed needed by a layer a day is_____.
- a. 80 grms.
 - b. 90 grms.
 - c. 105 grms.
 - d. 110 grms.

IV. READING RESOURCES

LESSON 1

PURPOSES OF FEEDING CHICKEN

WHAT TO KNOW?

At the end of the lesson, you should be able to:

1. discuss the purposes of feeding chicken;
2. explain the primary function of feeds;
3. identify the essential nutrients needed by the chicken; and
4. appreciate the value of efficient feed and feeding chicken.

PROCESS

Feeds have components called nutrients that aid or support animal's life.

Poultry birds require essential nutrients for growth, body maintenance, and egg production. These nutrients are supplied through the feeds and provide the bird's energy, protein, vitamins and mineral requirements.

For maximum efficiency, these nutrients have to be supplied at the right quality, quantity or in a balanced ration for each type of bird at any stage of growth.

Understanding the fundamentals of poultry feeding is essential in order that the birds may be fed economically for profitable business.

The biggest percentage of expenses incurred in poultry raising goes to feeds. Hence the poultry raiser should pay careful attention to this very important item in poultry production otherwise there will be an unnecessary amount of feed waste and, consequently, lower profits.

Essential Nutrients Needed by the Chicken

1. Protein. Its function is to repair broken tissues and maintain proper growth and development. A greater part of the animal's body such as the muscle, skin, feathers, blood, brains, tendons, and internal organs are made up principally of protein.

Sources of Plant Protein

- Soy bean meal
- Copra meal
- Sun-flower meal
- Ipil-ipil leaf meal

Sources of Animal Protein

- Fish meal
- Shrimp meal
- Meat and bone meal
- Blood meal

2. Energy. This constitutes a large portion of poultry feeds. Heat and energy are furnished in the poultry's body by these nutrients. Carbohydrates are also utilized as materials for fattening broilers.

Sources

Cereals - corn, rice, sorghum

Root crops – cassava, camote, gabi



Taken from Tech-Voc. Module

3. Fats. Its major function is to supply the birds with heat and energy.
4. Vitamins. Vitamins act as an aid to the feed in regulating bodily processes and supporting normal growth and reproduction. (A, B, D, and G)

5. Minerals. They are needed by the chicken's body especially for a hen laying 200 eggs in a year. A layer uses 40 ounces of mineral matter to form the shell of the eggs. The hen has only 2 ounces of mineral in her body. Mineral must therefore be added to the hen's ration to meet her mineral needs.

REFLECT AND UNDERSTAND

Choose the best answer. Write only the letter of your answer in your activity notebook.

1. The greatest percentage of all the expenses incurred in poultry production goes to cost of _____.
 - a. antibiotics
 - b. feeds
 - c. labor
 - d. stocks

2. Which is the primary function of feeds?
 - a. For fattening
 - b. For reproduction
 - c. For maintenance of life
 - d. For promotion of growth

3. Which is NOT true of yellow corn?
 - a. High in energy but low in fiber content
 - b. High in fiber but contains an adequate of fats
 - c. Highly digestible and palatable
 - d. One of the best grain for fattening

4. Which is NOT true about corn gluten feed?
 - a. A combination of corn gluten and corn bran
 - b. A combination of corn gluten and rice bran
 - c. A good source of carbohydrates
 - d. Contains twenty five percent protein

5. Which need the greatest quantity of nutrients for the rapid development of bones and muscle tissues?
 - a. Broilers
 - b. Chicks
 - c. Layers
 - d. Pullets

TRANSFER

1. Place a kilo of mature coconut meat under the sun until it becomes very dry. Chop and press the coconut to extract the oil. After the oil has been removed, cook the coco meat and squeeze it in a vat. Add some sugar or molasses. The finished product will be nutritious and delicious copra meal.
2. Collect a kilo of *tinapa* heads or any discarded parts of fish. Dry them under the sun and grind finely. This is an example of fish meal. It will provide a maximum of 45 percent protein to the chicken's diet.

FEEDBACK

The largest cost in raising poultry for meat and egg production goes to feeds. Understanding the fundamentals of poultry feeding is essential in order that the birds may be fed economically. Nevertheless, learners and poultry raisers should know the essential nutrients for chicken for them to be able to provide what is only beneficial to chicken for optimum production and maximize the utilization of investment. The next lesson will teach you how.

GLOSSARY

By- product	– secondary product produced in addition to the principal product
Crude protein	–includes the true protein and all other nitrogenous compounds in feeds
Fast growth	- characteristics of poultry to reach the desired market weight in the shortest possible time
Feeding	- the process of giving feeds to the animal
Feed ingredients	- the sources of nutrients which are used in preparing poultry feeds
Feeds	- edible materials which are consumed by animals that contribute energy and or nutrients to the animal diet
Nutrients	- substances which nourish and promote animal growth.
Palatable	- agreeable in taste
Poultry	- feathered animals that render economic service to men

RESOURCES:

Sugar or molasses
Knife
Cereals
Weighing scale
Pan and stove
Grains by-product
Coconut meat
Fish heads
Pail

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LESSON 2

FEED INGREDIENTS AND FORMULATING RATION FOR CHICKEN

WHAT TO KNOW?

At the end of the lesson, you should be able to:

1. identify/enumerate feed ingredients for formulating chicken ration;
2. formulate a simple ration for chicken;
3. explain/apply effective feeding practices for chicken; and
4. appreciate the value of efficient feed and effective feeding for chicken.

PROCESS

Purposes of Feeding

Chickens are fed for the purpose of supplying nutrients needed for their growth, maintenance, and reproduction. Broilers are marketed at a very young age (35-37 days). They need the greatest quantity of nutrients for the rapid development of bones and muscle tissues. Layers also need those nutrients that will keep them for the production of eggs and to replace worn out body tissues during egg production stage. Layers are self-liquidating six months after the point of lay.

Functions of Feeds

Feed is utilized by chicken for the following reasons:

1. To maintain life. The bulk of feed consumed by chicken is used to maintain life. What is over and above the requirement for life maintenance is utilized for growth and reproduction.
2. To promote growth. Broilers must have enough quality of feed for their growth. They are raised to be utilized for meat purposes while layers are raised for egg production.
3. To reproduce their kind. Production of fertilized eggs is necessary for hatching. Matured chickens need more feeds than younger ones for life maintenance and for reproduction.

Common Ingredients Used in Formulating Poultry Feeds

You must be familiar with the common feed ingredients that supply the nutrients needed.

Sources of Energy

A. Yellow corn. Yellow corn is one of the best grains for fattening chickens. It consists of eight to nine percent crude protein, high in energy and low in fiber. It is highly digestible and palatable. It contains vitamin A and yellow pigmenting compounds, thus obtaining the yellow color of the yolk.

Courtesy of CLSU



B. Rice bran. Rice bran is palatable to poultry of all ages. There are three types of rice bran in the market. They are known as D1, D2 and D3, respectively. Their crude protein content are the following:

Courtesy of MMFSL students



Type of rice bran

Crude Protein Content

D1	11 to 12%
D2	10%
D3	8.5 to 8.9%

A. Vegetable and Coconut oil – Plant oil are good source of energy for animals' diet.

B. Molasses. Molasses is the cheapest source of carbohydrates. It is a by-product in the manufacture of sugar. It should be used in a maximum of 4 %.

Sources of Protein

Plant Sources

A. Corn gluten feed (CP 18 to 20%). Corn gluten is a combination of corn gluten and corn bran mixed in such a proportion as to contain twenty five percent protein. It is a good source of carbohydrates.

B. Soy bean oil meal. There are two types of soy bean oil meal: high protein(46 % CP) and low protein ((43% CP). This is the only plant protein source that can replace animal protein in the diet with almost the same protein quality.

C. Ipil-ipil leaf meal- it contains twenty one (21%) protein, but is fed mostly for its vitamin A and yellow pigmenting properties.

D. Copra meal (20% CP). Copra meal is the by-product of the coconut meat after the oil has been extracted. It contains about twenty percent protein. It is the most common and cheapest source of plant protein.

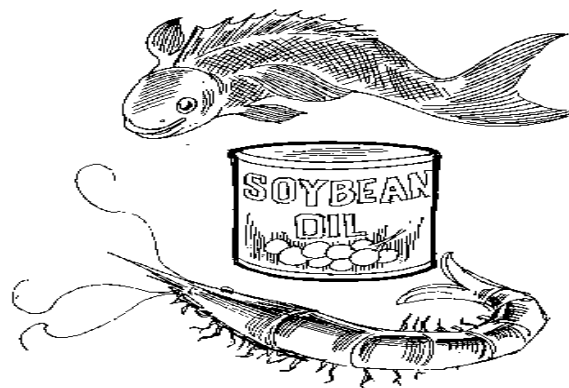


Taken from Tech-Voc. Module

Animal Sources

A. Fish meal (58 to 60 % CP). Fish meal is a good source of high quality protein. It contains about sixty to sixty five percent protein. It also contains an adequate amount of carbohydrates and fats.

B. Shrimp meal. Shrimp meal when dried and ground is a good source of protein. It contains about fifty six percent crude protein but low in energy. It may be used as substitute for fish meal.



Two major parts of shrimp are used in making shrimp meal, the shell (39% CP) and the head (46% CP).

Taken from Tech-Voc. Module

C. Meat and Bone meal (50% CP). These are by-products, trimmings of canning and meat processing industries.

Minerals. There are 13 minerals required by chicken. These are grouped into the macro and micro minerals. The macro minerals include calcium, phosphorous, chlorine, potassium, manganese, copper, zinc, iodine, and selenium. Cobalt, which is found in Vitamin B, is also essential for healthy red blood corpuscles. Calcium and phosphorous are needed for skeletal growth and bone and teeth development found in the fluids and soft tissues of the body. Salt improves the appetite, promotes growth, and is essential to hydrochloric acid formation in the stomach. Zinc protects the skin from the disease called mange. Iron and copper are necessary for the formation of hemoglobin in the red blood cells to prevent nutritional anemia. All these minerals are found in various feedstuff like farm-produced feeds, protein concentrates, and sea products.

Vitamins. These are organic substances important to the health and proper functioning of the animals. They are needed in small amounts. Vitamins are classified either as fat – soluble, which contains A, D, E, and K, or water- soluble which consists of the Vitamin B complex and Vitamin C.

FORMS OF FEED

- a. MASH - (physical form) a mixture of feed ingredients in meal form.



Courtesy of MMFSL Agri. Class

b. CRUMBLE- is a form of feeds which is made from crushed pellet.



Courtesy of MMFSL Agri. Class

c. PELLET – (physical form) feed formed by compacting through mechanical means



Courtesy of MMFSL Agri. Class.

KINDS OF POULTRY FEEDS

1. Pre-starter/Chick booster- given from day old to 2 wks; with 21.5 % to 23 % CP.
2. Chick starter- contains 20%-21% CP
3. Chick grower- contains 17 % CP
4. Finisher- given to finishing broiler
4. Pullet Developer – Contains 14 % CP
5. Layer Mash- should contain 17-18 % CP



Courtesy of MMFSL Agri. Class

Ration Formulation

The cost of poultry feeds makes up 70 to 80 percent of the total cost of production. It is a poultry raiser's concern to minimize the cost of feeds without affecting the health and vigor of the birds. This can be done successfully by formulating poultry rations.

The saying "Tell me the kind of feeds you are giving your birds and I will tell you what kind of birds you have" is true. In poultry nutrition, economical but nutritious feeds must be given to the birds.

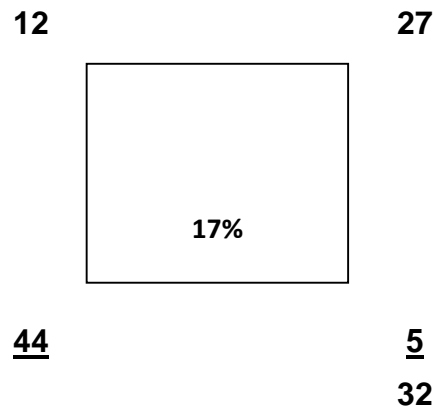
Pearson Square Method- This is a simple and easy method of determining the correct proportion of two feed ingredients without changing the feed's protein content. However, in balancing swine rations by the Pearson Square Method, only the protein content of the ration is given a major consideration.

To illustrate the application of this method, let us consider the sample problem below:

A poultry raiser wants to prepare a ration with 17 % CP for his flock. He has an adequate supply of rice bran and soybean oil meal. The protein content of rice bran is 12 percent while soybean oil meal has 44 percent protein. How much rice bran and soybean oil meal should be mixed to produce a 100 kilogram feed mixture containing the required protein allowance?

To solve the problem, follow these steps:

1. Construct a square and write in the middle of the square the desired percent of protein content of the ration.
2. On the upper left hand corner of the square, write the protein content of the energy source (rice bran). On the lower left hand corner, write the protein content of the protein supplement (soybean oil meal).
3. Draw a diagonal line from each corner; subtract the smaller number from the larger one diagonally across the square.



4. Get the total parts of rice bran and soybean.

$$(27.0 + 5.0 = 32).$$

5. The parts of each ingredient are simplified into a percentage of the total and these are multiplied to the desired quantity.

$$\frac{27.0 \text{ parts of RB}}{32.0 \text{ total parts}} \times 100 = 84.375 \text{ kg. RB}$$

$$\frac{5 \text{ parts of SB}}{32.0 \text{ total parts}} \times 100 = 15.625 \text{ kg. SB}$$

6. Check whether your answer is correct.

$$84.375 \text{ kg RB} \times .12 \text{ \% protein} = 10.125 \text{ \% CP}$$

$$15.625 \text{ kg soybean} \times .44 \text{ \% CP} = \underline{6.875 \text{ \% CP}}$$

$$17.00 \text{ \% CP}$$

Trial and Error Method. This is the most practical method to use in small scale farm operations. A ration formulated by using this method is balanced and ensures that necessary free nutrients are present.

Table below is an example of a practical way of formulating chicken ration using trial and error method as stated by E.C. Coligado, University of the Philippines College of Agriculture.

Ingredients (%Protein)	Starter (kg.)
Ground yellow corn (8.7)	41.0
Corn gluten meal (41.0)	13.0
Rice bran (13.5)	5.0
Copra meal (20.4)	5.0
Soy bean oil meal (44.0)	16.5
Fish meal (16.3)	12.0
Molasses (3.2)	
Ipil-ipil leaf meal (21.0)	1.0
Oyster shell flour	1.0
Salt	5.0
Vit.-Min.-mix	0.5
	100

Steps:

1. Determine the kind of feed you want to formulate.
2. Determine the crude protein content of feed you want to prepare.
3. Identify commonly available feed ingredients.
4. List them down as shown in the above Table with their protein content.
5. Decide on the amount of feed to prepare.
6. Make a calculated amount for each ingredient and multiply them to protein content of each ingredient.
7. If the total CP and amount of feed required are not met, TRY again.
8. Total the CP and the amount of feed, if both correspond to required CP and amount of feed mixtures, you are ready for mixing feed.

FEEDING GUIDE FOR THE GENERAL FLOCK

Broiler and layers require different kind of feeds as they grow.

Table below shows the type of ration requirements of birds.

Age (days)	Broiler (feed)	Age	Layer (feed)
1 to 7	Booster	1-10 days	Booster
8 to 14	Starter	11 days- 6 wks.	Starter
15 to 21	Starter	6-10 wks.	Grower
22 to 28	Grower	11-16 wks.	Developer
29 to 35	Grower/Finisher	1 week from 1 st	Pre-laying
36 to 42	Finisher	Drop of egg up to 5% of egg production.	
		5% of egg prod'n.	
			Laying feed

Courtesy of Villacorta Integrated Farm

Feeds given during the early stages of growth have higher protein content (22 to 24 percent) than those given during the later stages of growth (19 to 20 percent).

To find out how much corn is needed to maintain a hen for one year, multiply the weight of the hen by 8 and add 11.35 kilos.

- The main purpose of feeding laying hens is to have as many eggs as possible.
- Layer should consume an average of 110 grams. of feed in a day during laying stage to supply her daily maintenance and laying needs which can be given twice (6 am and 2 pm).

One of the factors that has improved the development of the poultry industry in our country is the availability of efficient feeds and effective feeding management.

Correct practices in feeding chicken start during their first day in the brooding house. An open type feeding trough or newspaper sheets should be used during the first few days of the chicks. Feeds are spread over several layers of newspaper sheets. These newspaper sheets must be changed every day until the chicks are big and strong enough to use the ordinary feeding trough.

REFLECT AND UNDERSTAND

Choose the best answer. Write only the letter of your answer in your activity notebook.

1. Which item below is NOT a function of water?
 - a. Acts as food carrier and tissue lubricant
 - b. Furnishes heat and energy in the poultry's body
 - c. Regulates body processes and supports normal growth
 - d. Supplies materials for the development and growth of bones

2. Which statement is NOT true of protein?
 - a. Aids in digestion and absorption
 - b. Is principally a greater part of the animal's body
 - c. Maintains growth and development
 - d. Repairs broken tissues

3. Which is the function of carbohydrate?
 - a. Acts as food carrier
 - b. Furnishes heat and energy
 - c. Regulates body processes
 - d. Supplies materials for growth and development

4. Which is the main function of fats?
 - a. Aids in the support of animal life
 - b. Supplies the animal's body with heat and energy
 - c. Supplies materials in the manufacture of egg shells
 - d. Utilized as material for fattening broiler

5. Below are principal sources of energy-producing nutrients EXCEPT_____.
 - a. cereals
 - b. copra meal
 - c. legume plants
 - d. root crops

6. Listed below are feeds for layers EXCEPT_____.
 - a. booster
 - b. grower
 - c. finisher
 - d. starter

7. Listed below are feeds for broiler EXCEPT
 - a. grower
 - b. developer
 - c. finisher
 - d. starter

8. Which form of feeds is made from crush pellet?
- a. Crumble
 - b. Grits
 - c. Mash
 - d. Pellet
9. Feeds given during the early stages of growth should have a protein content of_____.
- a. 16-18%
 - b. 19-21%
 - c. 22-24%
 - d. 25-27%
10. The average amount of feed needed of a mature layer in a day is
- a. 95gms.
 - b. 100 gms.
 - c. 105 gms
 - d. 110 gms.

TRANSFER

Activity # 1

Students are grouped into six (or any ideal group size for the class) to demonstrate the procedure in formulating a broiler ration using the different feed ingredients as reflected on the Table of feed formulation (Students will prepare feed mixture based on the available resources and problem that the teacher will provide). Practice both methods of formulating feed.

RESOURCES:

- 5 kls. Corn gluten
- 5 kls. Ground yellow corn
- 5 kls. Rice bran
- 1 kl. Copra meal
- 2 kls. Soybean oil meal
- ½ kl. Fish meal
- ¼ kl. Common salt
- Mixing pail
- Weighing scale

Activity # 2

Visit at least five backyard poultry raisers in your community. Interview them on what kind of feeds they give to their stocks. List down the kinds of feeds they are using. Evaluate whether they are giving the proper nutrient requirements to their stocks. Based on your findings write your comments and suggestions and discuss them in class.

Activity 3

Gather different kinds of green feeds in your garden. Chop them finely and place them in a separate feeder. Give it to your layer as green feeds. Observe which of these chopped green feeds are most likely to be eaten by the birds. Write your observations. Discuss them with your classmates.

V. SUMMATIVE ASSESSMENT

Choose the best answer. Write only the letter of your answer on your answer sheet.

1. The greatest percentage of expenses incurred in broiler production is cost of _____.
 - a. antibiotics
 - b. chicks
 - c. feeds
 - d. labor
2. Birds are fed for the purpose of supplying nutrients needed for their _____.
 - a. growth and development
 - b. life maintenance
 - c. reproduction
 - d. reproduction, life maintenance, growth and development
3. Which of the following reasons below is the primary function of feeds?
 - d. For fattening of their kind
 - e. For growth and development
 - c. For reproduction
 - d. For maintenance of life
4. For maximum efficiency, nutrients have to be supplied with the _____.
 - a. balanced ration
 - b. right quality of ration
 - c. right quantity of ration
 - d. right quality and quantity of balanced ration
5. Nutrients are supplied through the feeds which provide the birds with the needed _____.
 - a. Energy
 - b. Protein
 - c. fat
 - d. vitamins
6. Which of the choices below constitute the largest portion of poultry feeds?
 - a. Carbohydrates
 - b. Fats and ash
 - c. Protein
 - d. Vitamins

7. Which statement below best describes a yellow corn?
- a. High in fiber but contains an adequate amount of fats
 - b. One of the best grains in fattening chickens
 - c. The cheapest source of carbohydrates
 - d. The common and cheapest source of plant protein
8. Which is NOT a function of water?
- a. Acts as food carrier
 - b. Acts as tissue lubricant
 - c. Aids in digestion and absorption
 - d. Supplies the animal's body with energy
9. The kind of animal feed which has the highest protein content is_____.
- a. chick booster
 - b. chick starter
 - c. finisher feeds
 - d. grower feeds
10. Which of the following is NOT beneficially influenced by antibiotics?
- a. Feed conversion
 - b. Rate of growth
 - c. Reduction of mortality
 - d. Repair of broken tissues
11. Listed below are feeds for layers EXCEPT_____.
- a. Booster
 - b. Grower
 - c. Finisher
 - d. Starter
12. Listed below are feeds for broiler EXCEPT_____.
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13. Which form of feeds is made from crush pellet?
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14. Feeds given during the early stages of growth should have a protein content of_____.
- a. 16-18 %
 - b. 19-21 %
 - c. 22-24 %
 - d. 25-27 %
15. The daily average amount of feed needed by a layer a day is_____.
- a. 95 grms.
 - b. 100 grms.
 - c. 105 grms.
 - d. 110 grms.

VI. SUMMARY/FEEDBACK

Feeds eaten by poultry birds or nutrients provided to them by the raiser are transformed into heat and eggs which are useful to man for food and profit. Hence, the poultry raiser should pay careful attention to this very important item in poultry production, otherwise there will be an unnecessary amount of feed waste and, consequently, lower profits and worst, failure of the business.

The knowledge and skills in selection of stocks to raise and providing appropriate nutrition to them are important aspects for a successful poultry raising but a potential poultry raiser should possess another important aspect of poultry raising to have a higher percentage of success that is the ability to maintain optimum environment. This will be taken up in the next module.

GLOSSARY

Absorption– assimilation

Ad libitum– continuous feeding

Commercially mixed feeds – feeds of animals intended for sale

Digestion– the process of dissolving food in the stomach, so that can be turned into available nutrients for the body

Feed intake– the amount of feeds eaten by the birds

Moistened– slightly wet

Musty– with moldy odor

Nutritious– promoting nutrition, nourishing something

Overfeeding– feed intake is more than what is required

Ration– the amount of feed given to birds within 24 hours

Retarded– abnormally slow in development

Self-feeder– equipment where feeds are placed

Self-feeding– free to take feeds in the feeder

Stale– loss of freshness

Wastage– waste, worthless, loss of materials, minerals or waste products

RESOURCES

Feeds for layers

Feeds for broilers

Poultry equipment

Feeders

Waterers

Mixing pail

Weighing scale

Different feed ingredients

Paper

REFERENCES:

Broiler Production

MATEA-BASED TEXTBOOK

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