BETTER EGGS

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OREGON STATE COLLEGE · · · CORVALLIS

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Better Eggs

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In producing and maintaining egg quality, three major problems are involved: breeding, feeding, and care of the eggs after they are produced.

OREGON HAS CHANGED from an exporting to an importing state in market eggs and chicken meat. The main reason for this has been the increase in human population. Eggs are being imported mainly from the Midwest. To meet this competition Oregon poultrymen must produce top quality eggs.

The egg is a very perishable article of food. The income of the producer depends on the egg reaching the consumer with as much of its original quality as possible. The quality of the egg is never improved after it is laid. It is lowered quickly by many factors of management and by being exposed to high temperatures and low humidity. Any farmer who produces a surplus of eggs that must enter the channels of trade should provide suitable farm storage holding conditions for preserving the original quality of the eggs.

A farm egg-storage room or its equivalent should not be considered as an expense. It is a necessary piece of equipment, an investment that will pay dividends to the owner and to the industry.

Breeding for Egg Quality

Egg quality inherited

There are at least five inherited characteristics that have a bearing on egg quality. They are: egg size, egg shape, shell color, shell texture, and interior quality. Any marked or permanent improvement of any one or all of these characters will have to be brought about by selective breeding.

Selecting hatching eggs

There is some correlation between the type of egg a chick comes from and the type of egg the chick will produce when mature. For this reason, only first-grade eggs should be used for hatching.

Egg size, shape, and color have nothing to do with the interior quality, but they do have a direct bearing on the grade. Therefore, under-sized, odd-shaped, or off-colored eggs should be eliminated when hatching eggs are selected.

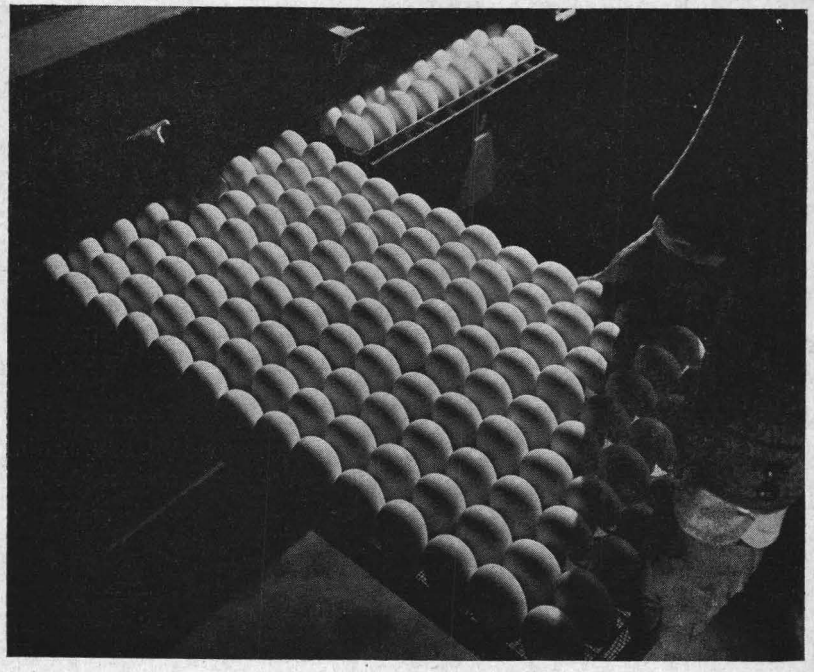

Figure 1. **Only first-grade eggs should be retained for hatching use.**

Shell texture is influenced considerably by high temperatures and type of ration fed. Some hens produce eggs with much better shells than others under the same environment, a fact which indicates shell texture may be influenced by heredity. For this reason, eggs with poor shells should be rejected as hatching eggs.

Various research workers have indicated that the percentage of thick and thin albumen an egg contains at the time it is laid is an individual characteristic of the bird and is inherited. Some breeders and hatcherymen make a practice of candling eggs before they go into the incubator. When this is done, eggs with a thin watery albumen and loose mobile yolk can be eliminated.

Selecting breeding stock

While some progress may be made in egg quality through the selection of hatching eggs, much faster and more permanent progress can be made if selection is practiced in the breeding stock. With such a program, pedigreed birds should be used, or at least pedigreed males. In commercial breeding, flocks in which pedigreed birds are not used,

occasionally a flock will be found producing especially high-quality eggs. Such flocks, when discovered, should be perpetuated. Hatcherymen and breeders should be encouraged to study egg quality as revealed through the candle and the open egg when selecting breeding stock.

Inasmuch as these various egg-quality characteristics are inherited both the male and female have an influence on the quality of eggs their offsprings will produce. In breeding for egg quality, however, the influence of the male birds is often overlooked.

Research workers from the U. S. Department of Agriculture Research Center at Beltsville, Maryland, report that by selecting breeding males on the basis of their sisters' and daughters' egg weights, the average egg weight of the female offspring was steadily improved. The average weight per dozen was increased from 21.9 ounces in December 1934 to 24.6 ounces in December 1938. In 4 years of this kind of selective breeding, pullets have been developed that lay fewer small eggs when they start to lay and produce eggs that have averaged higher in weight for the first year of lay. Improvement in other characteristics, such as shell color, shell texture, and interior quality, can no doubt be made through the use of pedigreed males.

Progeny test and family averages

If pedigreed males or females are being used in the breeding pens, the progeny test, or family averages, or both should be considered. The progeny test is judging the breeding value of an animal by the performance of its offspring. This is the only way to measure the true breeding value of any animal. If progeny test information is not available, family averages should be the next consideration. The type of eggs a male bird's sisters produce is a good indication of the egg characteristic he will transmit to his offspring. The family averages of the ancestors should also be considered when selecting pedigreed breeders.

Body size and egg size

It has been demonstrated that there is a correlation of body size and egg size within a flock. The larger birds have a tendency to produce the largest eggs. They do not only produce larger eggs, but on the average they are better producers. In selecting breeding stock, body size, equal to standard weight, should be taken into consideration.

Abnormal eggs

A few freak eggs such as dwarf eggs, double-yolked eggs, eggs within eggs, and abnormally shaped eggs may be produced under any system of breeding, feeding, or management. The laying of such eggs

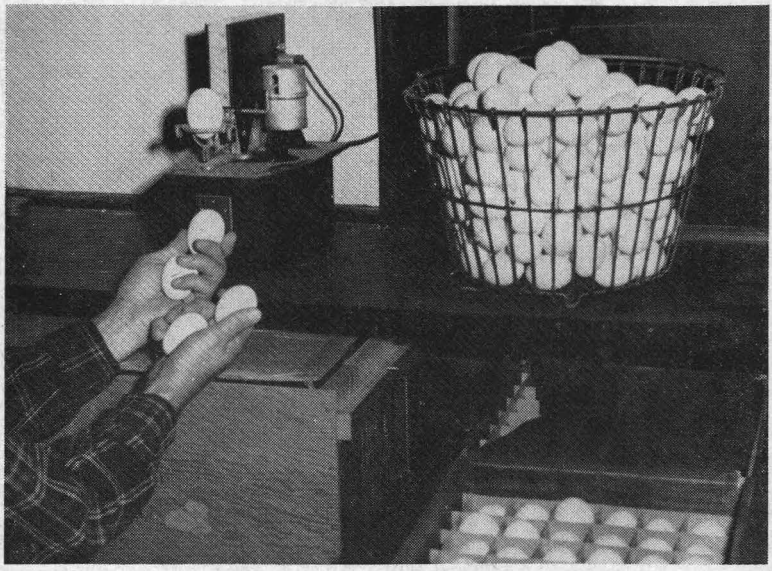

Figure 2. **Candling determines egg grade. See chart on center pages.**

is the result of some abnormal disturbance of the reproductive organs. As a rule the production of abnormal eggs is not a serious economic problem and is not inherited.

Occasionally a blood or meat spot will be found in an egg. A blood spot may be the result of a slight hemorrhage while the yolk is being formed or when it is released from the ovary. A meat spot may result from a blood spot, or from a piece of tissue having found its way into the oviduct.

Feeding for Egg Quality

Balanced rations

Generally speaking, well-balanced rations designed for high egg production will produce eggs of good quality. The usual procedure in feeding laying hens is to keep laying mash or pellets, oyster shell, and grit, before the birds at all times. In addition, they may be fed scratch grain in the evenings, depending on the system of feeding or type of ration used.

Yolk color

One of the most desirable characteristics in first-grade eggs is uniformity. Variation in yolk color is the most noticeable characteristic of eggs that is influenced by the ration. The principal yellow pigment of the yolk is found most abundantly in green feeds and yellow corn. If the total ration does not contain more than 50 per cent corn and more than 5 per cent alfalfa, the yolks will be uniform in color and not too dark.

Thick and thin albumen

The amount of thick and thin albumen an egg contains at the time it is laid is an inherited characteristic and is not influenced by the type of ration fed. High temperatures and low humidity are potent factors in changing the thick albumen to thin watery albumen after the egg is laid. These factors, along with heredity, apparently account for the variation found in the condition of the albumen.

Thin, watery whites are sometimes associated with the feeding of succulent green feeds. Large quantities of green feed will produce dark-colored yolks, often referred to as "grass eggs" but experimental results indicate that it does not influence the condition of the albumen.

Thin- and soft-shelled eggs

Thin-shelled eggs may be caused by lack of calcium or vitamin D in the ration. Approximately 95 per cent of the shell is calcium carbonate; thus an ample supply of calcium must be available to the hen either in the form of oyster shell, limestone grit, or calcite, all of which are high in calcium. In order that a hen may assimilate this calcium a sufficient amount of vitamin D must be present in the feed or obtainable through the sunlight. Although an adequate supply of calcium and vitamin D is necessary to produce shells of good quality, there is no indication that excessive feeding of them will improve shell texture.

High temperature during the summer months also has an influence on shell texture. When the temperature rises above 80 degrees, there is a sharp reduction in egg size and the shells become thinner and more fragile. Birds kept in a cool, well-ventilated house during the summer months will produce shells of better quality.

A soft-shelled egg is one that has been laid prematurely and before the secretion of shell material in the uterus. This may be caused by the shell gland failing to function or may occur before the reproductive organs become properly adjusted when a bird first starts to lay. There is no positive preventive of all soft-shelled eggs. When a well-balanced ration is fed and a well-planned system of management

is followed, the number of soft-shelled eggs will be small and unimportant.

Off-flavored eggs

Off-flavored eggs may usually be traced to the type of ration fed or to faulty storage conditions. Occasionally some individual hen will continue to produce off-flavored eggs regardless of the feed and care of the eggs. Such a condition, however, is seldom encountered. Rape, turnips, onions, fat fish or fish oils of poor quality, if fed in excess, may produce eggs with an off-flavor or bad odor. If a laying flock has free range, especially if it has access to a barnyard, there will be a wide variation in the quality of the eggs produced, which will often include strong or off-flavored eggs. Undesirable flavors will be absorbed by eggs held if they come in contact with strong odors.

Management for Egg Quality

Clean eggs essential for quality

One of the most important problems in poultry keeping is the production of clean eggs. Stained or dirty eggs are unattractive in appearance and must always be sold at a discount. Dirty eggs will spoil much more quickly than clean eggs. When the egg is laid, it is protected with a "bloom" called the cuticle. If the egg is soiled and then washed, scraped, wiped, or cleaned with a sand blaster, the cuticle is destroyed, which increases the opportunities for bacteria or molds to penetrate the shell pores and cause spoilage.

In order to reduce the number of dirty eggs, the laying house and nests must be kept clean. There should be at least one nest for every five hens. The nests should be well littered with rice hulls, straw, shavings, or excelsior, and the material used should be changed frequently to insure freedom from odors and filth. There should be wires or screen netting under the perches to keep the birds from walking in the droppings. If the birds have clean feet, they will not be so apt to soil the eggs. If the flock is confined or provided with a wire sun porch, cleaner eggs will be produced. Dirty eggs should be cleaned; but much time and labor will be saved and quality improved if clean eggs are produced.

Gather often and cool immediately

The interior quality of warm or heated eggs deteriorates rapidly. Eggs should be gathered three to four times a day to preserve the original quality and prevent them from getting dirty. If eggs remain in the nest during warm weather, or if several eggs are laid in the

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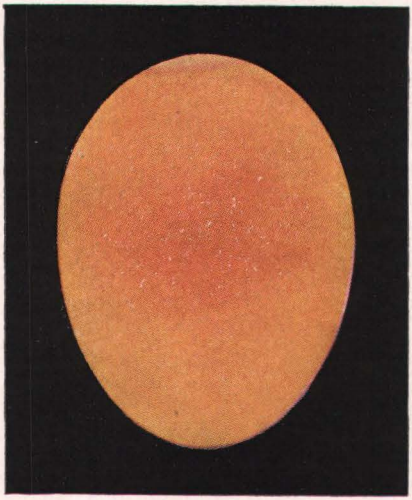
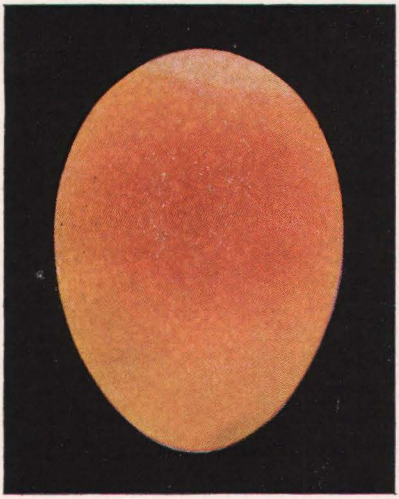
Illustrations of candled appearance of white-shelled eggs showing r



AA Quality

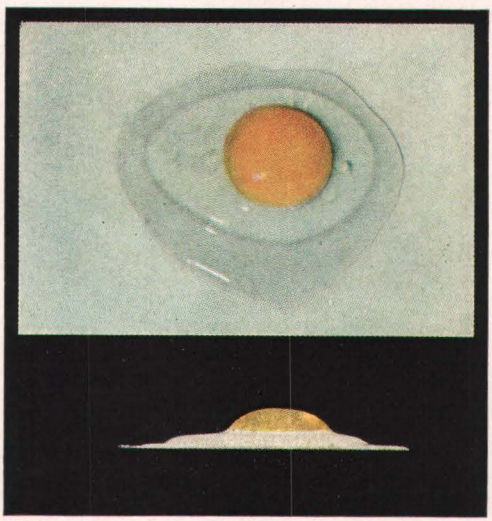
1. Shell—clean; unbroken; practically normal.
2. Air cell—1/8 inch or less in depth; practically regular.
3. White—clear; firm.
4. Yolk—well centered; outline slightly defined; free from defects.



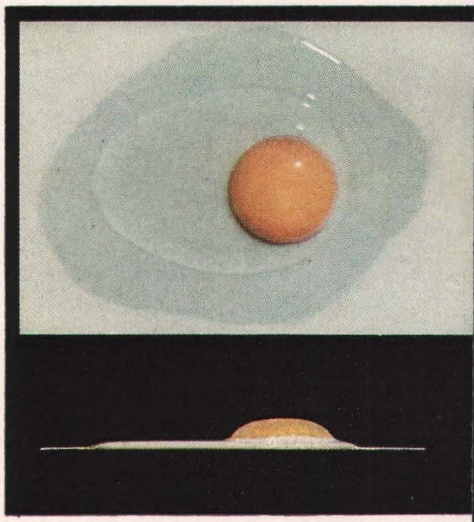
A Quality

1. Shell—clean; unbroken; practically norm
2. Air cell—2/8 inch or less in depth; pr tically regular.
3. White—clear; may be reasonably firm.
4. Yolk—may by fairly well centered; outli fairly well defined; practically free from defe

Illustrations of broken-out appearance (to



AA Egg covers small area; much thick white surrounds yolk; has small amount of thin white; yolk round and upstanding.



A Egg covers moderate area; has considerab thick white; medium amount of thin whit yolk round and upstanding.

Graders should check their work by breaking out an egg occasionally and comparing

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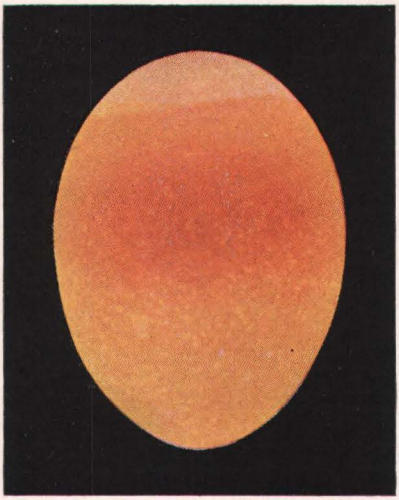
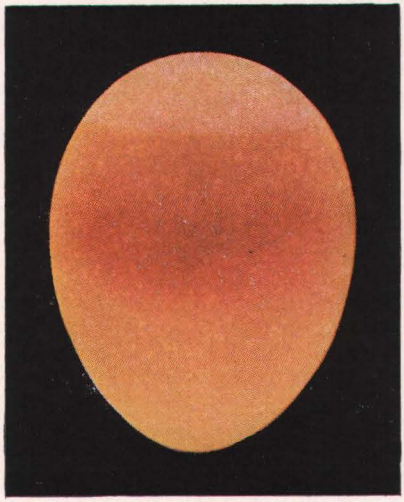
LITY OF INDIVIDUAL SHELL EGGS

um depth of air cell and outline and position of yolk in each quality



B Quality

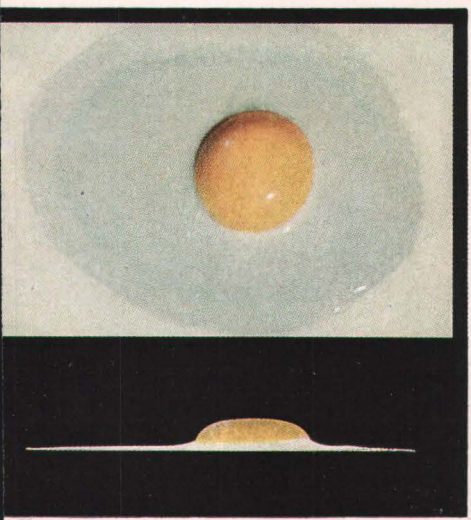
1. Shell—clean; unbroken; may be slightly abnormal.
2. Air cell—3/8 inch or less in depth; may show movement not over 3/8 inch; if not over 2/8 inch, may be free.
3. White—clear; may be slightly weak.
4. Yolk—may be off center; outline well defined; may be slightly enlarged and flattened; may show definite but not serious defects.



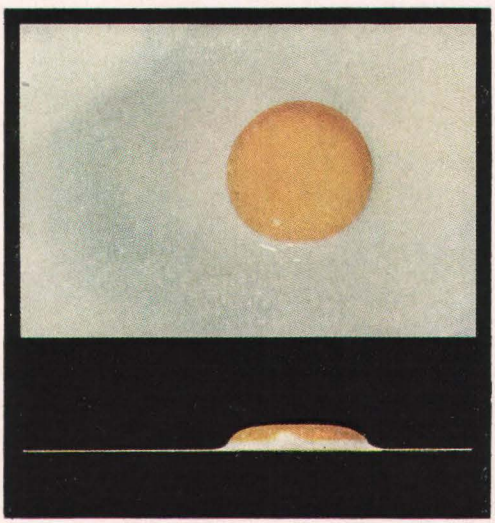
C Quality

1. Shell—clean; unbroken; may be abnormal.
2. Air cell—may be over 3/8 inch in depth; may be free or bubbly.
3. White—clear; may be weak and watery; small blood clots or spots may be present.
4. Yolk—may be off center, enlarged, and flattened; may show clearly visible germ development but no blood; may show other serious defects; outline plainly visible.

side views) of each quality—⅓ actual size



Egg covers wide area; has small amount of thick white; much thin white; yolk somewhat attened and enlarged.



C Egg covers very wide area; has no thick white; large amount of thin white thinly spread; yolk very flat and enlarged.

is chart. U. S. Department of Agriculture, Production and Marketing Administration.

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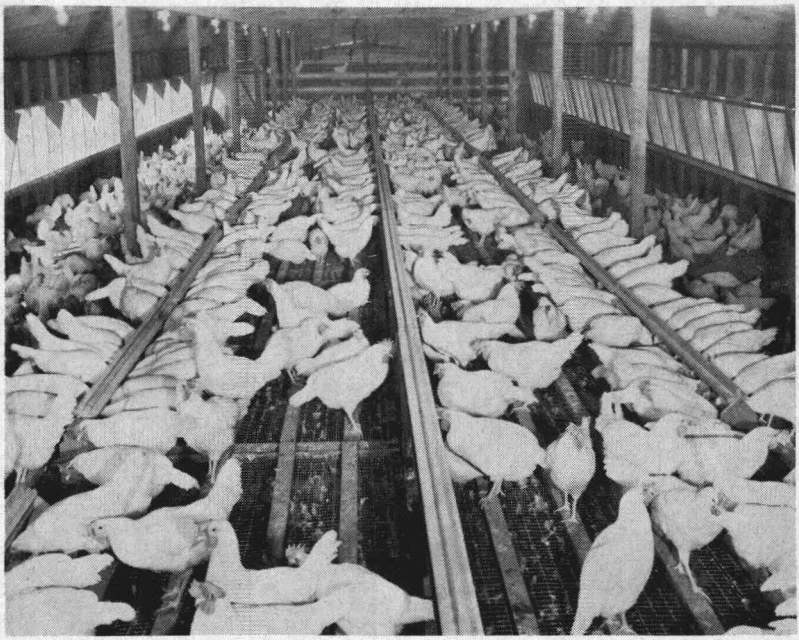

Figure 3. **Feed and watering troughs on roosts, and dropping pits covered with heavy gage wire, will help to keep litter dry and eggs clean.**

same nest, the quality is rapidly reduced. Wire, rubber-coated pails that are kept clean make desirable egg baskets.

The sooner eggs are cooled after they are laid, the better the quality will be. Eggs should not be cased until they have been completely cooled. They cool much faster in a wire basket than in a galvanized pail, or a chilled egg case.

Time, temperature, and humidity

The three most important factors in preserving quality after the eggs are laid are time, temperature, and humidity. Eggs are a perishable product and unless given proper care deteriorate rapidly. The sooner eggs are marketed, the better the quality will be. With proper environment, however, the quality can be maintained for a considerable length of time. During summer months, eggs should be marketed at least twice a week. They should be protected from high temperatures and low humidity while held on the farm or in transit to market. In order to preserve the original quality, eggs should be kept at a

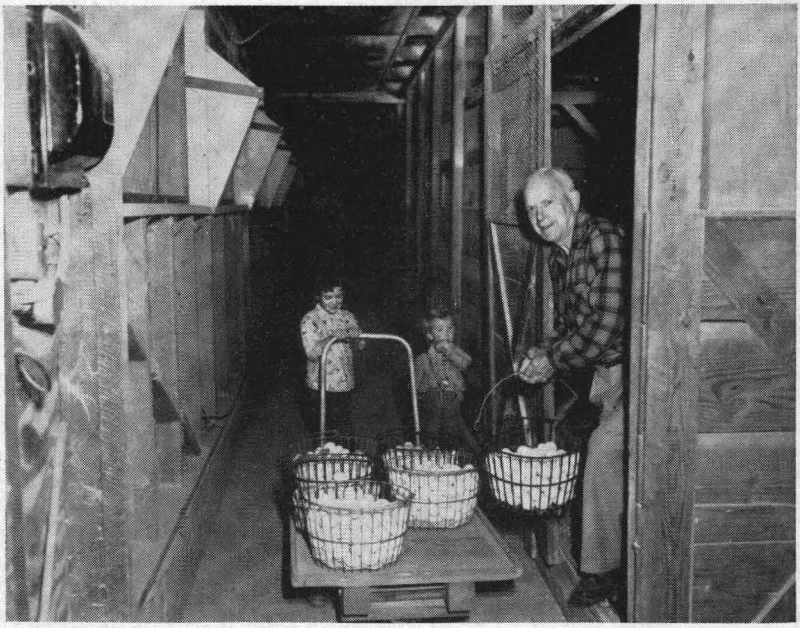

Figure 4. **Eggs should be gathered 3 to 4 times a day to preserve the original quality and prevent them from getting dirty. They should be gathered in wire, rubber-coated egg baskets.**

temperature ranging from 40° to 60° F. with a relative humidity above 80 per cent.

When the temperature is high and humidity low, the deterioration that takes place in the egg is greatly increased. Under these conditions, the thick albumen is changed to a thin, watery albumen; bacteria, if present, multiply rapidly; the passage of water from the albumen to the yolk is increased; and evaporation, which increases the size of the air cell, takes place at a rapid rate. Experimental results indicate that the high humidity is even more important than low temperature in preserving egg quality.

Rough handling lowers quality

A new-laid egg is made up of three layers of albumen, an outer layer of thin white, a middle layer of thick white, and an inner layer of thin white. The outer layer makes up about 22 per cent of the albumen by weight, the inner layer about 25 per cent, and the middle layer of thick white about 53 per cent. Rough handling of eggs has a

Figure 5. **An insulated egg storage room 8 by 12 feet, equipped with a cooler and humidifier. Eggs should be left in wire baskets to cool before they are cased.**

tendency to break down these partitions between the layers of thick and thin albumen, causing the thick white to become diluted with the thin white. Rough handling of eggs has a tendency to increase the number of tremulous air cells and is a factor in reducing the number of first-grade eggs. A tremulous air cell is a dislocated or movable air cell. A normal air cell is located in the large end of the egg between the two shell membranes and is free from any movement.

Market eggs should be infertile

Cell division will take place in a fertile egg when the temperature is above 68° F. When this occurs, the quality deteriorates rapidly. It is much easier to preserve quality with infertile eggs. Male birds should never be allowed in the laying flock except when hatching eggs are desired.

Proper care of hatching eggs essential

In general, hatching eggs should be cared for in a manner similar to that described for market eggs. When eggs are held longer than 7 days, there is a slight reduction in hatchability and after 14 days, the reduction increases quite rapidly. Hatching eggs should be gathered often, cooled immediately, and kept at a temperature between 50° and 60° F., with a humidity above 80 per cent. When fertile eggs are exposed to temperatures above 68° F., cell division starts—then stops when temperatures drop, thereby reducing hatchability, as some embryos may die before the eggs ever go into the incubator. Some eggs that are taken out of the incubators as infertile may be eggs in which the embryos died while being held for hatching or during early stages of incubation. Some of the reduction in fertility and hatchability that occurs during the latter part of the hatching season and when warm weather approaches is due to improper care of the hatching eggs. Hatching eggs should be turned daily if held longer than a week. (See Figure 6.)

Effect of Storage Conditions

Proper storage improves grade

Table 1 emphasizes the advantage of holding eggs in a humidified egg-storage room in comparison with eggs held in a feed room and in an unhumidified egg-storage room.

In this experiment the humidified egg-storage room was 5 by 10

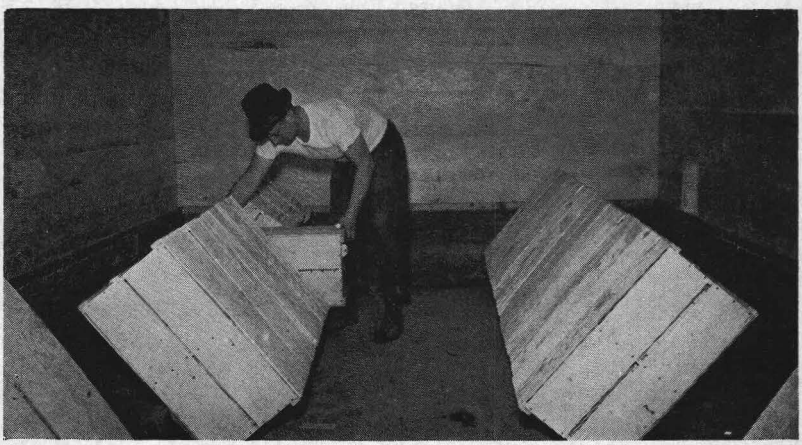

Figure 6. **Hatching eggs should be held in an egg-storage room and should be turned daily if they are stored longer than one week.**

Table 1. FARM EGG-STORAGE CONDITIONS AND THEIR EFFECT ON EGG GRADES

	Days eggs held	Number of eggs	U. S. egg grades				
			AA	A	B	C	Chex
			Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Eggs held in feed room (Average relative humidity 52%, average maximum temperature 80° F.)							
Trial No. 1	5	360	35.28	56.67	5.83	0.83	1.39
Trial No. 2	8	360	1.67	31.67	66.67	.00	.00
Trial No. 3	6	360	33.33	46.66	20.00	.00	.00
Average	....	.....	23.43	45.00	30.83	.28	.46
Eggs held in unhumidified egg-storage room, 2-story building (Average relative humidity 60%, average maximum temperature 70° F.)							
Trial No. 1	5	360	47.22	49.44	2.50	0.83	0.00
Trial No. 2	8	360	3.33	43.33	53.33	.00	.00
Trial No. 3	6	360	51.66	40.00	6.66	.00	1.66
Average	....	.....	34.07	44.26	20.83	.28	.56
Eggs held in humidified egg-storage room, 1-story building (Average relative humidity of 83%, average maximum temperature 66° F.)							
Trial No. 1	5	360	62.50	34.44	1.67	0.28	1.11
Trial No. 2	8	360	61.67	35.00	1.67	1.67	.00
Trial No. 3	6	360	66.66	26.66	6.66	.00	.00
Average	....	.....	63.61	32.04	3.33	.65	.37

feet, with double walls and ceiling lined with sawdust and equipped with a cooler and humidifier. The unhumidified egg-storage room was similarly constructed except that it was not equipped with a cooler and humidifier. The feed room was 10 by 20 feet, located in one end of the laying house. The eggs were gathered four times a day, divided into three lots, and allowed to cool overnight in their respective holding rooms before they were cased.

Three trials were conducted and the eggs were held 5, 8, and 6 days respectively. The cases were numbered 1, 2, 3, and unidentified as to holding conditions when candled. The eggs were graded by the same commercial candler.

Of eggs held in the humidified egg-storage room on the average 63.61 per cent qualified for AA grade; 34.07 per cent qualified for AA grade in the unhumidified egg-storage room; and only 23.43 per cent qualified for AA grade in the feed room.

The large reduction of first-grade eggs held in the feed room and unhumidified room in the second trial was apparently due to increased

length of time the eggs were held. Eggs in the humidified room continued to maintain their quality during the period.

As indicated in Table 1, the average relative humidity was 23 per cent higher in the humidified egg room than in the unhumidified storage room and 31 per cent higher than in the feed room. The average maximum daily temperature was 4° lower in the humidified room than in the unhumidified room and 14° lower than in the feed room. This is particularly significant since the unhumidified room was located on the first floor of a two-story poultry house, whereas the humidified storage room was located in a much warmer one-story poultry house.

Construction of an insulated egg room

The egg room should be located close to the laying house for convenience in placing the eggs in cool storage immediately after each gathering. Frequently one end of the laying house is used for an egg-storage room. A well-constructed room where the temperature can be maintained at from 40° to 60° F. and the relative humidity can be held at 80 per cent or above is particularly important in maintaining egg quality. The egg room should be insulated to give best results. Matched siding or shiplap can be used on the exterior walls of the room and the interior lined with matched lumber or plywood. This is nailed to the vertical studding and dry sawdust or shavings can be used as insulation material to fill the space between the inner and outer walls. It is important that the insulation material be dry before being placed in the wall. Ceiling insulation is important and should be similar to the walls. If a dry, inexpensive material is not available the egg room can be lined with ½-inch insulation board. This will not equal dry shavings or sawdust, but should be satisfactory.

The entrance door can be made up on the farm with 6-inch flooring on the outside and plywood or insulation board on the inside with one or two layers of building paper between. Diagonal bracing would be required. The door should fit tight against the jamb to prevent air leakage.

The size of the room should be approximately 6 x 12 feet for twice-a-week egg delivery for flocks of 2,500 to 3,000 birds.

Many poultry supply dealers carry mechanical coolers or refrigerator units that can be purchased and installed in an insulated egg-storage room.

Summary

Breeding

Egg quality is inherited and any marked or permanent improvement will have to be brought about by selective breeding. Some progress may be made through selection of hatching eggs, but much faster progress can be made through the use of pedigreed male birds and the application of the progeny test and family averages.

Feeding

In general, the type of ration that will give good production will produce eggs of good quality. Yolk color is influenced by the amount of green feeds and yellow corn in the ration. The amount of thick and thin albumen an egg contains at the time it is laid is an inherited characteristic and is not influenced by feed. Thin-shelled eggs may be caused by lack of minerals, lack of vitamin D, improper balance of these ingredients, and high temperatures.

Management

Cleaner and more uniform eggs will be produced if the laying flock is confined and the laying house nests are kept clean. Eggs should be gathered three or four times a day and cooled immediately before they are cased. Eggs should be marketed at least twice a week during the warm weather. They should be held in an egg-storage room at a temperature ranging from 40 to 60 degrees with a relative humidity above 80 per cent. Market eggs should be infertile. Hatching eggs should be held at a temperature from 50 to 60 degrees with a relative humidity above 80 per cent.

Storage

The egg room should be insulated and equipped with a mechanical cooler or refrigerator unit. It should be located close to the laying house for convenience. It should be constructed and equipped to maintain a temperature from 50 to 60 degrees with a relative humidity above 80 per cent.

The colored chart, United States Standards for Quality of Individual Shell Eggs, was furnished by U. S. Department of Agriculture.

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