This sample chapter is taken from Milo M. Hastings' classic book, *The Dollar Hen*, Published by Norton Creek Press, 2003. ISBN 0972177019. Retail price $18.95.

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Chapter 11. Quality In Eggs

Because of the readiness with which eggs spoil, the term "fresh" has become synonymous with the idea of desirable quality in eggs. As a matter of fact the actual age of an egg is quite subordinate to other factors which affect the quality.

An egg forty-eight hours old that has lain in a wheat shock during a warm July rain would probably be swarming with bacteria and be absolutely unfit for food. Another egg stored eight months in a first-class cold storage room would be perfectly wholesome.

Grading Eggs

Eggs are among the most difficult of food products to grade, because each egg must be considered separately and because the actual substance of the egg cannot be examined without destroying the egg. From external appearance, eggs can be selected for

size, color, cleanliness of shell and freedom from cracks. This is the common method of grading in early spring when the eggs are uniformly of good quality.

Later in the season the egg candle is used. In the technical sense any kind of a light may be used as an egg candle. A sixteen candle-power electric lamp is the most desirable. The light is enclosed in a dark box, and the eggs are held against openings about the size of a half dollar. The candler holds the egg large end upward, and gives it a quick turn in order to view all sides, and to cause the contents to whirl within the shell. To the expert this process reveals the actual condition of the egg to an extent that the novice can hardly realize. The art of egg candling cannot be readily taught by worded description. One who wishes to learn egg candling had best go to an adept in the art, or he may begin unaided and by breaking many eggs learn the essential points.

Eggs when laid vary considerably in size, but otherwise are a very uniform product. The purpose of the egg in nature requires that this be the case, because the contents of the egg must be so proportioned as to form the chick without surplus or waste, and this demands a very constant chemical composition.

For food purposes all fresh eggs are practically equal. The tint of the yolk varies a little, being a brighter yellow when green food has been supplied the hens. Occasionally, when hens eat unusual quantities of green food, the yolk show a greenish brown tint, and appear dark to the candler. Such eggs are called "grass eggs;" they are perfectly wholesome.

An opinion exists among egg men that the white of the spring egg is of finer quality and will stand up better than summer eggs. This is true enough of commercial eggs, but the difference is chiefly, if not entirely, due to external factors that act upon the egg after it is laid.

There are some other peculiarities that may exist in eggs at the time of laying, such as a blood clot enclosed with the contents of the egg, a broken yolk or perhaps bacterial contamination. "Tape worms," so-called by egg candlers, are detached portions of the membrane lining of the egg. "Liver spots" or "meat spots" are

detached folds from the walls of the oviduct. Such abnormalities are rare and not worth worrying about.

The shells of eggs vary in shape, color and firmness. These variations are more a matter of breed and individual idiosyncrasy than of care or feed.

The strength of the egg shell is important because of the loss from breakage. The distinction between weak and firm shelled eggs is not one, however, which can be readily remedied. Nothing more can be advised in this regard than to feed a ration containing plenty of mineral matter and to discard hens that lay noticeably weak shelled or irregularly shaped eggs.

Preference in the color of eggs shells is well worth catering to. As is commonly stated, Boston and surrounding towns want brown eggs, while New York and San Francisco demand white eggs. These preferences take their origin from there being large henneries in the respective localities producing the particular class of eggs. If the eggs from such farms are the best in the market and were uniformly of a particular shade, that mark of distinction, like the trade name on a popular article, would naturally become a selling point. Only the select trade considers the color in buying.

Eggs of all Mediterranean breeds are white. Those of Asiatics are brown. Those of the American breeds are usually brown, but not of so uniform a tint.

The size of eggs is chiefly controlled by the breed or by selection of layers of large eggs. In a number of experiments published by various experiment stations, slight differences in the sizes of the eggs have been noted with varying rations and environment, but this cannot be attributed to anything more specific than the general development and vigor of the fowls. Pullets, at the beginning of the laying period, lay an egg decidedly smaller than those produced at a later stage in life.

The egg size table on page 162 gives the size of representative classes of eggs. These figures must not be applied too rigidly, as the eggs of all breeds and all localities vary. They are given as approximate averages of the eggs one might reasonably expect to find in the class mentioned.

How Eggs Are Spoiled

Dirty eggs are grouped roughly in three classes:

1. Plain dirties, those to which soil or dung adheres.
2. Stained eggs, those caused by contact with damp straw or other material which discolors the shell (plain dirties when washed usually show this appearance).
3. Smeared eggs, those covered with the contents of broken eggs.

For the first two classes of dirty eggs the producer is to blame. The third class originates all along the route from the nest to consumer. The percentage of dirty eggs varies with the season and weather conditions, being noticeably increased during rainy weather. In grading, about five percent of farm-grown eggs are thrown out as dirties. These dirties are sold at a loss of at least twenty percent.

The common trade name for cracked eggs is "checks." "Blind checks" are those in which the break in the shell is not readily observable. They are detected with the aid of the candle, or by sounding, which consists of clicking the eggs together. "Dents" are checks in which the egg shell is pushed in without rupturing the membrane. "Leakers" have lost part of the contents and are not only an entire loss themselves, but produce smeared eggs.

The loss from breakage varies considerably with the amount of handling in the process of marketing. A western produce house collecting from grocers by local freight will record from four to seven percent of checks. With properly handled eggs the loss through breakage should not run over one or two percent.

Eggs in which the chick has begun to develop are spoken of as "heated" eggs. Infertile eggs cannot heat because the germ has not been fertilized and can make no growth. That such infertile eggs cannot spoil is, however, a mistaken notion, for they are subjected to all the other factors by which eggs may be spoiled.

The sale of eggs tested out of the incubators has been encouraged by the dissemination of the knowledge that infertile eggs are not changed by incubation. Eggs thrown out of an incubator will be shrunken and weakened, and some of them may contain dead

GEOGRAPHICAL CLASSIFICATION	BREED CLASSIFICATIONS	Net Wt. Per 30 Dozen Case	Weight Ounces Per Dozen	Relative Values Per Dozen
Southern Iowa's "Two ounce eggs"	Purebred flocks of American varieties of "egg farm Leghorns."	45 lbs	24	25¢
Poorest flocks of Southern Dunghills	Games and Hamburgs.	35 lbs	19.2	20¢
Average Tennessee or Texas eggs.	Poorest strains of Leghorns.	40 lbs	21.3	22¢
Average for the United States as represented by Kansas, Minnesota and Southern Illinois.	The mixed barn yard fowl of the western farm, largely of Plymouth Rock origin.	45 lbs.	28	24¢
Average size of eggs produced in Denmark.	American Brahmas and Minorcas.	48 lbs.	25.6	27¢
Selected brands of Danish eggs.	Equaled by several pens of Leghorns in the Australian laying contest.	54 lbs	28.8	30¢

Figure 10. Egg size table

germs and the remains of chicks that have died after starting to develop. Such eggs may be sold for what they are, but should never be mixed with other eggs or sold as fresh. When carefully candled they should be worth 10¢-12¢ a dozen.*

Fertile eggs, at the time of laying, cannot be told from infertile eggs, as the germ of the chick is microscopic in size. If the egg is immediately cooled and held at a temperature below 70°, the germ will not develop. At a temperature of 103°, the development of the chick proceeds most rapidly. At this temperature the development is about as follows:

Twelve hours incubation: When broken in a saucer, the germ spot, visible upon all eggs, seems somewhat enlarged. Looked at with a candle such an egg cannot be distinguished from a fresh egg.

* This practice is not longer legal, at least in Oregon.

Twenty-four hours: The germ spot mottled and about the size of a dime. This egg, if not too dark-shelled, can readily be detected with the candle, the germ spot causing the yolk to appear considerably darker than the yolk of a fresh egg. Such an egg is called a heavy egg or a floater.

Forty-eight hours: By this time the opaque white membrane, which surrounds the germ, has spread well over the top of the yolk, and the egg is quite dark or heavy before the light. Blood appears at about this period, but is difficult of detection by the candler, unless the germ dies and the blood ring sticks to the membrane of the egg.

Three days: The blood ring is the prominent feature and is as large as a nickel. The yolk behind the membrane has become watery.

Four days: The body of the chick becomes readily visible, and prominent radiating blood vessels are seen. The yolk is half covered with a water containing membrane.

These stages develop as given, occurring at a temperature of 103°. As the temperature is lowered the rate of chick development is retarded, but at any temperature above 70°, this development will proceed far enough to cause serious injury to the quality of the eggs.

For commercial use eggs may be grouped in regard to heating as follows:

1. *No heat shown*. Cannot be told at the candle from fresh eggs.
2. *Light floa*ts. First grade that can be separated by candling, corresponding to about twenty-four hours of incubation. These are not objectionable to the average housewife.
3. *Heavy floats.* This group has no distinction from the former, except an exaggeration of the same feature. These eggs are objectionable to the fastidious housewife, because of the appearing of the white and scummy looking allantois on the yolk.
4. *Blood rings.* Eggs in which blood has developed, extending to the period when the chick becomes visible.
5. *Chicks* visible to the candle.

The loss due to heated eggs is enormous; probably greater than that caused by any other source of loss to the egg trade. The loss varies with the season of the year, and the climate. In New England, heat loss is to be considered as in the same class as loss from dirties and checks. In Texas the egg business from the 15th of June until cool weather in the fall is practically dead. People stop eating eggs at home and shipping out of the State nets the producer such small returns by the time the loss is allowed that, at the prices offered, it hardly pays the farmer to gather the eggs. In the season of 1901 hatched chickens were commonly found in cases of market eggs throughout the trans-Mississippi region, and eggs did well to net the shippers 3¢ per dozen.

Damage to eggs by heating and consequent financial loss is inexcusable. In the first place, market eggs have no business being fertilized, but whether they are or not they should he kept in a place sufficiently cool to prevent all germ growth.

The egg shell is porous so that the developing chick may obtain air. This exposes the moist contents of the egg to the drying influence of the atmosphere. Evaporation from eggs takes place constantly. It is increased by warm temperatures, dry air and currents of air striking the egg.

When the egg is formed within the hen the contents fill the shell completely. As the egg cools the contents shrink, and the two layers of membrane separate in the large end of the egg, causing the appearance of the bubble or air cell. Evaporation of water from the egg further shrinks the contents and increases the size of the air cell. The size of the air cell is commonly taken as a guide to the age of the egg. But when we consider that with the same relative humidity on a hot July day, evaporation would take place about ten times as fast as on a frosty November morning, and that differences in humidity and air currents equally great occur between localities, we see that the age of an egg, judged by this method, means simply the extent of evaporation, and proves nothing at all about the actual age.

Even as a measure of evaporation, the size of the air cell may he deceptive, for when an egg with an air cell of considerable size is roughly handled, the air cell breaks down the side of the egg,

and gives the air cell the appearance of being larger than it really is. Still rougher handling of shrunken eggs may cause the rupture of the inner membrane, allowing the air to escape into the contents of the egg. This causes a so-called watery or frothy egg. The quality is in no way injured by the mechanical mishap, but eggs so ruptured are usually discriminated against by candlers.

In this connection it might be well to speak further of the subject of "white strength," by which is meant the stiffness or viscosity of the egg white. The white of an egg is a limpid, clear liquid, but in the egg of good quality that portion immediately surrounding the yolk appears to be in a semi-solid mass. The cause of this appearance is the presence of an invisible network of fibrous material. By age and mechanical disturbance this network is gradually broken down and the liquid white separates out. Such a weak and watery white is usually associated with shrunken eggs. Them eggs will not stand up well or whip into a firm froth and are thrown in lower grades.

The weakness of the yolk membranes also increases with age, and is objectionable because the breakage of the yolk is unsightly and spoils the egg for poaching.

The shrunken egg is most abundant in the fall, when the rising prices tempt the farmer and groceryman to "hold" the eggs (delay bringing them to market because waiting will bring higher prices in spite of the drop in quality). This holding is so prevalent, in fact, that from August to December full fresh eggs are the exception rather than the rule.

While we have called attention to evaporation as the most pronounced fault of fall eggs, losses from other causes are greatly increased by the holding process.

If the eggs are held in a warm place, heat and shrinkage will case the greatest damage; if held in a cellar, rot, mold, and bad odors will cause the chief loss.

The loss due to shrunken eggs is not understood nor appreciated by those outside the trade. Such ignorance is due to the fact that the shrunken is not so repulsive as the rotten or heated egg. But the inferiority of the shrunken egg is so well appreciated by the consumer that high class dealers find it impossible to use them

without ruining their trade. The result is that shrunken eggs are constantly being sent into the cheaper channels, with the result that all lower grades of eggs are more depreciated in the fall of the year than at any other time.

In the classes of spoiled eggs, of which we have thus far spoken, the proverbial rotten egg has not been considered. The term "rot" in the egg trade is used to apply to any egg absolutely unfit for food purposes. But I prefer to confine the term "rotten egg" to the egg which contains a growth of bacteria.

The normal egg when laid is germ-free. But the egg shell is not germ-proof. The pores in the egg shell proper are large enough to admit all forms of bacteria, but the membrane inside the shell is germ proof as long as it remains dry. When this membrane becomes moist so that bacteria may grow in it, these germs of decay quickly grow through it and contaminate the contents of the egg.

Heat favors the growth of bacteria in eggs and sufficient cold prevents it, but as bacteria cannot enter without moisture on the surface of the egg we can consider dampness as the cause of rotten eggs. Moisture on the shell may come from an external wetting, from the "sweating" of eggs coming out of cold storage, or by the prevention of evaporation to such an extent that the external moisture of the egg thoroughly soaks the membrane. The latter happens in damp cellars, and when eggs are covered with some impervious material.

Rotten eggs may be of different kinds, according to the species of germ that causes the decomposition. The specific kinds of egg rotting bacteria have not been worked out, but the following three groups of bacterially infected eggs are readily distinguishable in the practical work of egg candling.

1. *Black rots.* It is probable that many different species of bacteria cause this form of rotten eggs. The prominent feature is the formation of hydrogen sulfide gas, which blackens the contents of the egg, gives the characteristic rotten egg smell and sometimes causes the equally well known explosion.

2. *Sour eggs or white rots.* These eggs have a characteristic sour smell. The contents become watery, the yolk and the whites mix and the whole egg is offensive to both eye and nose.
3. *The spot rot.* In this the bacterial growth has not contaminated the whole egg, but has remained near the point of entrance. Such eggs are readily picked out with the candle, and when broken open show lumpy adhesions on the inside of the shell. These lumps are of various colors and appearances. It is probable that these spots are caused as much by mold as by bacteria, but for practical purposes the distinction is immaterial.

In practice it is impossible to separate rotten from heated eggs for the reason that in the typical nest of spoiled eggs found around the farm, both causes have been at work. Dead chicks will not necessarily cause the eggs to decay, but many such eggs do become contaminated by bacteria before they reach the candler, and hence, as a physician would say, show complications.

The loss of eggs that are actually rotten is not as great as one might imagine. Perhaps one or two percent of the country's egg crop actually rot, but the expenses of the candling necessitated, and the lowering of value of eggs that contain even a few rotten specimens are severe losses.

Moldy or musty eggs are caused by accidentally wet cases or damp cellars and ice houses. The moldy egg is most frequently a spot rot. In the musty egg proper the meat is free from foreign organisms, but has been tainted by the odor of mold growth upon the shell or packing materials.

The absorption of odors is the most baffling of all causes of bad eggs. Here the candler, so expert in other points, is usually helpless. Eggs, by storage in old musty cellars, or in rooms, with lemons, onions and cheese, may become so badly flavored as to be seriously objected to by a fancy trade, and yet there is no means of detecting the trouble without destroying the egg. Such eggs occur most frequently among the held stock of the fall season.

THE LOSS DUE TO CARELESSNESS

The egg crop of the country, more than ninety-five percent of which originates on the general farm, is subject to immense waste due to ignorant and careless handling. The great mass of eggs for sale in our large cities possess to a greater or less degree the faults we have discussed.

Some idea of the loss due to the present shiftless method of handling eggs, may be obtained by a comparison of the actual average prices received for all eggs sold in New York City, and the wholesale prices quoted by a prominent New York firm dealing in high grade goods. The contrasted price for the year 1907 are shown in figure 11.

Prices at which total goods moved		**Wholesale prices for strictly fresh eggs**	
January	25.8	January	42
February	24.5	February	40
March	19.3	March	32
April	16.9	April	30
May	16.6	May	31
June	15.5	June	32
July	15.6	July	35
August	17.7	August	38
September	20.7	September	40
October	21.4	October	42
November	26.0	November	45
December	27.7	December	48

Figure 11. Average prices vs. strictly fresh prices

The total values figured by multiplying these prices by the New York receipts, are as follows:

Amount actually received:	$23,832,000
Values at quotations for strictly fresh:	$44,730,000

No one would contend it is possible to bring the entire egg crop of the country up to the latter value, but the fact that there is a definite market for eggs of first class quality at almost double the figures for which the egg crop as a whole is actually sold, is a point very significant to the ambitious producer of high grade eggs.

Requisites For the Production of High Grade Eggs

1. Hens that produce a goodly number of eggs, and at the same time an egg that is moderately large (average two ounces each). Plymouth Rocks, Wyandottes, Rhode Island Reds, Orpingtons, Leghorns, Minorcas are the varieties which will do this.
2. Good housing, regular feeding and watering, and above all clean, dry nests.
3. Daily gathering of eggs, when the temperature is above 80 degrees, gathering twice a day.
4. The confining of all broody hens as soon as discovered.
5. The rejection as doubtful of all eggs found in a nest which was not visited the previous day. (Such eggs should be used at home where each may be broken separately).
6. The placing as soon as gathered of all summer eggs in the coolest spot available.*
7. The prevention at all times of moisture in any form coming in contact with the egg's shell.

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* Eggs should be refrigerated immediately after collection.

8. The selling of young cockerels before they begin to annoy the hens. Also the selling or confining of old male birds from the time hatching is over until cool weather in fall.
9. The using of cracked and dirty, as well as small eggs, at home. Such eggs if consumed when fresh are perfectly wholesome, but when marketed are discriminated against and are likely to become an entire loss.
10. Keeping eggs away from musty cellars or bad odors.
11. Keeping the egg as cool and dry as possible while en route to market.
12. The marketing of all eggs at least once per week and oftener, when facilities permit.
13. The use of strong, clean cases or cartons and good fillers.