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GRADING and INSPECTION of EGGS and EGG PRODUCTS

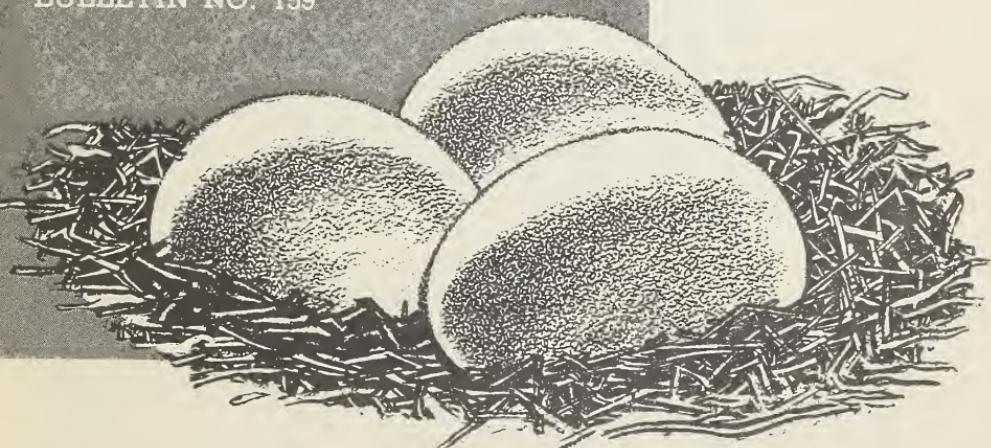
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AGRICULTURE INFORMATION
BULLETIN NO. 159



Agricultural Marketing Service

UNITED STATES DEPARTMENT OF AGRICULTURE

PREFACE

The purpose of this bulletin is to present comprehensive information on one of the most important factors contributing to the improvement, identification, and maintenance of quality in the production and merchandising of eggs and egg products. In order to market eggs effectively to the greatest advantage to producers, consideration must be given to the consumer reaction on size, cleanliness of shells, and interior quality of shell eggs and the wholesomeness and functional quality of egg products. Producers do not have much incentive or adequate reward for producing and delivering clean, unbroken eggs of good interior quality unless their eggs are purchased by quality grade and weight class at proper price differentials.

The information in this bulletin should stimulate thought on means of developing a greater coordination of effort in improving practices in the marketing of eggs and egg products. It is intended to aid Federal, State, and industry leaders who are encouraging the use of uniform standards and grades for eggs. It will also aid agencies responsible for consumer education in preparing information on inspected and graded shell eggs and egg products in line with existing conditions.

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GRADING and INSPECTION of EGGS and EGG PRODUCTS

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Modern merchandising has brought about many changes in the marketing of eggs. The growing demand for eggs of uniform quality and weight has encouraged grading. Consumers are willing to pay necessary price differentials for better-than-average quality and for larger size.

The necessity of adequately reimbursing producers for high-quality eggs has become more acute due to the increase in size and numbers of commercial flocks. Producers with large flocks are more conscious of net returns and those with high-quality eggs are sought after by country assembly plants which are more and more tending to grade and carton eggs for immediate distribution into consumer channels. Since many of the former marketing steps are performed at one point, the time between production and delivery to the consumer is reduced greatly. This results in better-quality eggs in retail channels.

PART I SHELL EGGS

The grading and classing of eggs is a process of sorting them according to quality and weight. Grades define the limit of tolerance for error in measuring the factors involved in establishing the standard of quality of an individual egg. To be practical, consideration must also be given to the differences which arise between graders when applying subjective measurements and for normal changes in quality in the marketing channel. Weight classes define the minimum weight of individual eggs and the minimum average weight of the eggs contained in a dozen, case or lot.

Marketing Practices

The majority of our egg production passes through one or more marketing channels. However, some producers market their entire production directly to the consumer.

Whether the eggs move directly or indirectly, it is necessary to have a basis for establishing values. The producer marketing his eggs directly may find that sorting the eggs by weight is sufficient to satisfy his customer. That is possible because under good production methods there is a high degree of uniformity in the other factors which

establish the value of his product when the eggs are properly handled and marketed within a few days. It is generally considered good practice for the producer to remove soiled, cracked, and misshapen eggs and to candle the eggs to remove those containing unsightly material such as blood spots and occasional inedible eggs.

From the time eggs began to move in commercial channels, there has been some point between the producer and the consumer where an examination has been made in an effort to determine their value. Such examination might have been for weight, cleanliness, soundness of shell or color of shell. It soon became evident, however, that consumers had to be satisfied with the broken-out appearance of the eggs if the egg industry was to meet the competition of other food products. Some buyers used a water test to determine the loss of water from the egg. Eggs with large air cells tended to stand on end.

Candling is now, and for many years has been, the accepted method for determining interior quality of eggs. The U. S. Department of Agriculture has recently promulgated standards and grades based on flock selection to determine certain interior quality factors. Statistical analysis has proven that eggs from a flock of one strain and which are of uniform age will be consistently more uniform in quality than eggs from flocks of various strains and ages which have been sorted for quality by candling. The albumen height measurements from thousands of eggs were analyzed, and it was found that a sample of 5 or 10 eggs from such flocks was an accurate basis for evaluating the important factor of albumen quality. The grades and standards promulgated for use by this method of testing are predicated on requirements for the producer with regard to farm practices affecting egg quality, such as cooling.

It is safe to say that today most eggs are graded for one or more of the primary factors before being offered to the consumer. At the retail level the letters AA, A, B, and C are most generally used to indicate grade. Name grades are used in wholesale channels.

Grading for Quality

Quality and value in eggs depend on the basic factors which apply to all foods; namely, nutritive value, convenience, wholesomeness, functional properties, and acceptability. These factors are listed in order of increasing variability among eggs. Eggs do not vary much in nutritive value, but they vary a great deal in acceptability.

All eggs sold to consumers should be graded to determine their quality, to make certain that only good eggs reach consumers, and to enable consumers to purchase the quality desired. Quality is determined by four primary factors: Condition of the yolk, clarity and thickness of the white, texture and condition of the shell, and condition and size of the air cell.

The most common method of evaluating these factors is by use of a suitable candling light in a darkened room. Such a device is equipped with an aperture through which light is concentrated and before which the egg is twirled to examine the interior quality. It also has an opening at the bottom to provide light under which the eggs can be examined for shell cleanliness and abnormalities. The combination of candling by hand or over multiple lights on conveyors, together with measuring the albumen height from a small sample from each flock, is rapidly gaining in popularity.

The grading of shell eggs involves the classifying of the individual egg according to established standards. The distinction between standards of quality and grades should be understood. Standards of quality refer to a factor or group of factors which indicate the relative degree of excellence of one unit of product. They are the means of classifying each egg according to various groups of conditions and characteristics that research and experience have shown to be related to consumer preference and acceptance. Grade identification is applied to groups of eggs such as dozens or cases. Grades provide tolerances for a small percentage of eggs below the stated quality.

Producers and egg handlers should be familiar with the standards and grades specified in the laws of the State in which the eggs are to be sold. Copies of State egg laws should be obtained from the State bureau of markets or State department of agriculture and should be studied carefully.

Some Effects of Marketing Eggs According to Uniform Grades

Selling eggs on a graded basis makes producers more conscious of the factors in production which influence quality and size, as well as the factors which have a bearing on the rate of deterioration of the quality in eggs. There is a direct correlation of egg weight and quality to the price received for eggs when sold on a graded basis. There is abundant evidence that the better-than-average producer obtains higher returns by selling eggs on a graded basis.

Some advantages of marketing eggs on a graded basis may be stated briefly as follows:

To Producer

1. Encourages production of higher quality eggs.
2. Stimulates improvement in flock management.
3. Reflects the economic significance of egg weight.
4. Increases returns to producers of better-quality eggs.
5. Furnishes a reliable basis for evaluating market price reports.

To Central Assembly Plants

1. Provides basis for developing a quality improvement program.
2. Lowers procurement and handling costs.
3. Attracts producers of high quality eggs.
4. Facilitates direct sale to retail distributing agencies.

To Wholesalers and Jobbers

1. Provides a reliable basis for determining egg value.
2. Reduces costs of handling.
3. Reduces effort and costs in retaining old accounts and securing new ones.
4. Makes it possible to pay and obtain higher prices for uniform quality packs.
5. Eliminates need for personal inspection of product.

To the Retailer

1. Reduces handling costs.
2. Enables the purchasing of quality and size to meet consumer's preference.
3. Encourages the use of refrigeration for maintaining quality.
4. Makes possible more effective merchandising by displays and advertising.
5. Establishes a reliable basis for brand names.
6. Aids in attracting and holding regular customers.

To the Consumer

1. Provides assurance of the quality and weight as stated.
2. Permits selection of desired quality and weight.
3. Provides basis for evaluating consumer information on uses.
4. Helps in evaluating variable prices listed.

Need for Uniform Terminology of Standards and Grades on a National Basis

Since a large part of the eggs produced move a considerable distance from the point of production, it would seem to follow that the function of grading can best be performed if the grades and standards used are the same in all areas of the United States. Price information as published in Market News reports and advertisements cannot be compared except on the basis of known quality and weights. They cannot be compared unless the product can be described. Grades are the "shorthand" for such description. To be most effective, a uniform system must be employed. Industry leaders are working continuously toward this goal. When a nationally produced and nationally used commodity can be described and discussed in uniform terms, confidence in trading results. Educational programs on grades are more easily planned and executed, and they contribute larger benefit to the entire industry. Also, brand names can be more easily established and their reputation strengthened.

The use of uniform grade standards and terminology does not suggest elimination of trade brands nor conflict with the use of them in any way. Trade brands should be used in conjunction with uniform grade identification to enhance good merchandising effort. They tend to increase pride on the part of the person or firm packing and selling eggs and confidence of the wholesale and retail dealers and consumers in the grading skill, efficiency, and integrity of the packers.

The various qualities of eggs when packed under uniform standards and grades more readily find the most suitable market outlets. This can materially reduce distribution costs and give greater consumer understanding and satisfaction.

Considerable progress has been made in establishing uniformity in standards, grades, and weight classes since 1925. There is continued interest on the part of State marketing officials, consumer groups, and industry members in continuing the work toward adoption of national standards and grades.

Egg laws have been enacted in all of the 50 States. Most of the recent laws, and the revisions of the older laws, are concerned with grading, grade labeling, and accurate representation of the product to

the consumer at the retail level. Most of the enforcement effort is directed toward retail outlets, although eggs are also inspected at the wholesale and jobbing levels.

A survey of State egg laws in effect on January 1, 1961, indicates that progress is being made in obtaining uniformity by use of U. S. standards for quality and grades for shell eggs.

How the U. S. Standards and Grades Were Developed

In 1923 the Department of Agriculture began developing standards and grades for shell eggs. This was considered necessary because of the confusion and misunderstanding that arose from the use of classifying terms indicative of the locality of production and hence suggestive of possible quality, such as Midwestern Extra, Pacific Coast Whites, and Nearby Hennery Whites. The first standards were introduced in tentative form and sent out to the trade in 1925.

The standards have been revised periodically up to the present time on the average of every 4 or 5 years. Representatives of producers, retailers, jobbers, wholesalers, and consumers are advised of proposed changes in the regulations and are given an opportunity to express their views. The suggestions received are carefully reviewed before making them a part of the regulation. Basically, these standards and grades have not varied to any great extent from those originally proposed; but minor changes have been made from time to time to keep pace with developments in egg marketing and new information. A modification in the standards effective since December 1, 1946, was made on March 1, 1955. The change eliminated "stained" eggs as a separate quality classification, and included in varying proportions eggs with stained or soiled shells in "B," "C," and "Dirty" qualities, depending on the intensity and area of the stain.

An amendment, effective September 15, 1959, made minor changes in the tolerances of Procurement No. 1 Grade to improve the quality and uniformity of the eggs within the grade. It also established new Export Grades that are similar to the Procurement Grades, with the exception of the packaging requirements.

In issuing national standards for eggs, the U. S. Department of Agriculture acts as a coordinating agency, with responsibility primarily for reflecting research developments and consolidating the ideas and recommendations of all interested groups, as a service to the poultry industry and especially to producers.

In order to be satisfactory, standards and grades must be understood by producer and market men alike. They must have a common meaning and they should be coordinated on a national basis to assure uniformity.

The United States Standards and Grades

The United States Standards for Quality of Individual Shell Eggs are applicable only to eggs of the domesticated chicken that are in the shell. The grades are applicable to shell eggs in "lot" quantities, rather than on an "individual" egg basis. A lot may consist of a dozen, or larger quantity.

Standards for Quality of Individual Shell Eggs

The quality standards for individual shell eggs are the foundation for the whole program of standardization. They provide for seven qualities. They are: AA Quality and A Quality, which must have clean, sound shells, and B Quality and C Quality, which may be clean or slightly to moderately stained. The other three qualities are: Dirlties, Checks, and Leakers.

Explanation of terms descriptive of the four primary quality factors and a more detailed discussion of these standards can be found in the Regulations Governing the Grading and Inspection of Shell Eggs and United States Standards, Grades and Weight Classes for Shell Eggs. A summary of the specifications for each quality factor is given in table 1.

TABLE 1.—Summary of United States Standards for Quality of Individual Shell Eggs

SPECIFICATIONS FOR EACH QUALITY FACTOR

Quality Factor	AA Quality	A Quality	B Quality	C Quality
Shell-----	Clean Unbroken. Practically normal.	Clean. Unbroken. Practically normal.	Clean; to very slightly stained. Unbroken. May be slightly abnormal.	Clean; to moderately stained Unbroken. May be abnormal.
Air Cell---	$\frac{1}{8}$ inch or less in depth. Practically regular.	$\frac{1}{8}$ inch or less in depth. Practically regular.	$\frac{1}{8}$ inch or less in depth. May be free but not bubbly.	May be over $\frac{1}{8}$ inch in depth. May be free or bubbly.
White-----	Clear. Firm.	Clear. May be reasonably firm.	Clear. May be slightly weak.	May be weak and watery. Small blood clots or spots may be present. ¹
Yolk-----	Well centered. Outline slightly defined. Free from defects.	May be fairly well centered. Outline may be fairly well defined. Practically free from defects.	May be off center. Outline may be well defined. May be slightly enlarged and flattened. May show definite but not serious defects.	May be off center. Outline may be plainly visible. May be enlarged and flattened. May show clearly visible germ development but no blood. May show other serious defects.

¹ If they are small (aggregating not more than $\frac{1}{8}$ inch in diameter).

For eggs with dirty or broken shells, the standards of quality provide three additional qualities. These are:

Dirty	Check	Leaker
Unbroken. May be dirty.	Checked or cracked but not leaking.	Broken so contents are leaking.

Grade Tolerances

Officially graded eggs shall conform as nearly as possible to the specifications of the respective standards of quality. It is not possible with present equipment to do a perfect job at practical operating speeds of sorting qualities so that each lot will contain 100 percent of the quality designated. However, the grader must make every effort to do so in order that the tolerance permitted will not be exceeded. For example, although U. S. Grade A provides for a maximum tolerance of 20 percent eggs below A Quality, the grader must strive to include no eggs below A Quality in order to assure delivery of Grade A eggs to the receiver. This is necessary because there is a constant loss in quality even under the best practical handling conditions. This loss in quality can be minimized materially under favorable temperature and moisture conditions. Tolerances are permitted within each grade only as an allowance for variable efficiency and interpretation of conscientious graders, normal changes under favorable conditions during reasonable periods between grading and inspection, and reasonable variation from inspector's interpretation. Substitution of higher qualities for those specified is permitted.

Tolerances allowed for lower qualities in wholesale grades are greater than is acceptable for retail trading and include tolerances for loss which are not included in the consumer grades. A carload or truckload of eggs usually contains considerable variation in quality, and wholesale grades allow for this.

Consumer Grades

Consumer grades are intended primarily for application to lots of eggs that have been carefully candled and graded for retail sale. As the name implies, eggs graded and identified as a consumer grade are suitable for immediate use without further handling. These grades are also widely used by hospitals, restaurants and other group feeding establishments which purchase eggs in case lots. The identification of eggs by consumer grades has become more extensive as a result of the enactment of laws by a number of States requiring eggs to be sold at retail on a graded basis. No inedible eggs are permitted in consumer grades.

There are four consumer grades for eggs; namely, U. S. Grade AA or Fresh Fancy Quality, U. S. Grade A, U. S. Grade B, and U. S. Grade C. These grades differ from the U. S. Wholesale Grades primarily in stricter tolerance of not over 20 percent for eggs below the major specified quality and in providing no tolerance for inedible or "loss" eggs. A summary of standards for U. S. Consumer Grades for Shell Eggs is given in table 2.

The weight classes applicable to the U. S. Consumer Grades for Shell Eggs are: Jumbo, Extra Large, Large, Medium, Small, and Pee wee (table 3).

The grade letters indicate quality only. The weight class is stated separately and indicates the weight of the dozen in ounces, or of the 30-dozen case in pounds. A Grade A egg has the same quality, whether it is small or large. Grade A eggs are not necessarily large; Grade AA eggs are not necessarily extra large, and Grade B eggs are not necessarily medium or small.

TABLE 2.—*Summary of U. S. Consumer Grades for Shell Eggs*

U. S. consumer grade	At least 80 percent (lot average) ¹ must be—	Tolerance permitted ²	
		Percent	Quality
Grade AA or Fresh Fancy Quality.	AA quality-----	15 to 20----- Not over 5 ³ -----	A. B, C, or check.
Grade A-----	A quality or better-----	15 to 20----- Not over 5 ³ -----	B C, or check
Grade B-----	B quality or better-----	10 to 20----- Not over 10 ³ -----	C. Dirty, or check.
Grade C-----	C quality or better-----	Not over 20-----	Dirty, or check.

¹ In lots of 2 or more cases, no individual case may fall below 70 percent of the specified quality and no individual case may contain more than double the tolerance specified for the respective grade (i. e., in lots of Grade A, not more than 10 percent of the qualities in individual cases within the sample may be C or Check, provided the average is not over 5 percent).

² Within tolerance permitted, an allowance will be made at receiving points, or shipping destination for $\frac{1}{2}$ -percent leakers in Grades AA, A, and B, and 1 percent in Grade C.

³ Substitution of higher qualities for the lower qualities specified is permitted.

TABLE 3.—*U. S. Weight Classes for Consumer Grades for Shell Eggs (Applicable to All Consumer Grades)*

Size or weight class	Minimum net weight per dozen	Minimum net weight per 30 dozen		Minimum weight for individual eggs at rate per dozen ¹
		Ounces	Pounds	
Jumbo-----	30	56	29	
Extra Large-----	27	50 $\frac{1}{2}$	26	
Large-----	24	45	23	
Medium-----	21	39 $\frac{1}{2}$	20	
Small-----	18	34	17	
Peewee-----	15	28	—	

¹ Minimum weights listed for individual eggs at the rate per dozen are permitted in various size classes only to the extent that they will not reduce the net weight per dozen below the required minimum.

Wholesale Grades

The U. S. Wholesale Grades are intended for use in wholesale channels of trade. They differ from consumer grades in that they provide a tolerance for a small percentage of "loss," or inedible eggs. They are applicable to both carlot and less than carlot shipments as packed at shipping points, or as received at terminal wholesale and distributing markets. The principal value of wholesale grades is to describe the inherent quality of large commercial lots of eggs on the basis of potential yield of completely graded edible eggs.

These grades are of primary interest to dealers of eggs in large volume, rather than to producers. They also serve the interests of the

TABLE 4.—Summary of United States Wholesale Grades for Shell Eggs

Substitution of eggs possessing higher qualities, for those possessing lower specified qualities is permitted.

Q: The actual total percentage must be stated in the grade name.

TABLE 5.—*Weight Classes for United States Wholesale Grades for Shell Eggs*

Weight classes	Per 30 dozen eggs		Weights for individual eggs at rate per dozen
	Average net weight on a lot ¹ basis	Minimum net weight individual case ² basis	
At least—		Minimum weight	Weight variation tolerance for not more than 10 percent, by count, of individual eggs
Extra large	50½ pounds	50 pounds	26 ounces
Large	45 pounds	44 pounds	23 ounces
Medium	39½ pounds	39 pounds	20 ounces
Small	34 pounds	None	None

¹ Lot means any quantity of 30 dozen or more eggs.

² Case means standard 30 dozen egg case as used in commercial practice in the United States.

producers in that their use promotes egg standardization and tends to improve the general quality of eggs in commerce and even the quality which the consumer receives. At various times, the wholesale grades have been used for trading on mercantile exchanges. During World War II and since then, the Chicago Mercantile Exchange and the New York City Mercantile Exchange have used U. S. Standards of Quality as a basis for trading grades, which rather closely conform to the U. S. Wholesale Grades. The four grades of Specials, Extras, Standards, and Trades are based upon stated percentages of AA, A, B, and C Quality of eggs, respectively (table 4). In the U. S. Wholesale Grades, tolerances for eggs below the major specified quality and for inedible eggs or "loss" are permitted to allow for deterioration in transit and unavoidable human errors in grading which are likely to occur when eggs are candled at a rate of speed necessary in a commercial operation.

The weight classes for U. S. Wholesale Grades for Shell Eggs are practically identical with the weight classes for the consumer egg grades (table 5). They are subject to a stated tolerance of 10 percent and apply to all wholesale grades, except U. S. DIRTIES and U. S. CHECKS. There are no weight classes for U. S. DIRTIES or U. S. CHECKS.

Procurement Grades

The U. S. Procurement Grades are applicable only to shell eggs in lot quantities. They are designed primarily for institutional procurements and are used extensively by governmental, as well as private institutions. Most of the Armed Service procurement is based on these grades.

TABLE 6.—*Summary of U. S. Procurement Grades for Shell Eggs*

U. S. Procurement Grade	A quality or better (lot average) at least ¹	Maximum tolerance permitted ² (lot average)		
		Percent	Percent	Quality
I-----	80	15 to 20----- Not over 5-----	-----	B. C, Check, Dirty, Leaker, and Loss.
II-----	60	30 to 40----- Not over 10-----	-----	B. C, Check, Dirty, Leaker, and Loss.
III-----	40	48.3 to 60----- Not over 11.7-----	-----	B. C, Check, Dirty, Leaker, and Loss.
IV-----	20	68.3 to 80----- Not over 11.7-----	-----	B. C, Check, Dirty, Leaker, and Loss.

¹ Individual cases may contain not over 10 percent less A Quality eggs than permitted for the lot, provided the average for the lot is not more than the tolerance permitted in any grade. In lots of 200 cases or more, one case in each 10 examined may contain not over 20 percent less A Quality eggs than is permitted in any grade.

² Within each tolerance for qualities below B, each of the grades may contain not over 3 percent Checks, and a combined total of not over $\frac{3}{10}$ percent DIRTIES, Leakers, and Loss. Loss other than meat spots and blood clots and spots must not exceed 0.15 percent at origin and 0.20 percent at destination. Individual cases of Procurement Grades I, II, III, and IV may contain not over 10 percent, 15 percent, 18 percent and 18 percent respectively, of qualities below Grade B provided the average for the lot does not exceed the tolerance permitted in the grade.

TABLE 7.—Weight Classes for United States Procurement Grades

Weight classes	Average net weight on lot basis 30-dozen case	Minimum net weight individual 30-dozen case	Minimum net weight of individual eggs at rate per dozen	Maximum average percent of individual eggs below minimum weight lot average ¹
Extra large-----	Pounds 50. 5	Pounds 50	Ounces 26	Percent 3. 33
Large-----	45	44. 5	23	3. 33
Medium-----	39. 5	39	20	3. 33
Small-----	34	33. 5	17	3. 33

¹ Individual cases may contain not over 10 percent of individual eggs below minimum weights specified in any weight class, but such eggs shall weigh not less than the minimum specified for the next lower weight class.

Export Grades

The U. S. Export Grades are provided for voluntary use by shell egg exporters. These grades are similar to the U. S. Procurement Grades. Eggs graded and labeled as an export grade must be packed in new standard cases and new standard packing material. Each case must be plainly marked in English and in the language of the importing country to show the name of the product, the quantity, and the size. When the importing country requires marking on the individual egg, such marking must be legible.

TABLE 8.—Summary of U. S. Export Grades for Shell Eggs

U. S. export grade	A quality or better (lot average) at least ¹	Maximum tolerance permitted ² (lot average)		
		Percent	Percent	Quality
I or A-----	80	15 to 20----- Not over 5-----	B. Edible eggs below B quality.	
II-----	60	30 to 40----- Not over 10-----	B. Edible eggs below B quality.	
III-----	40	48.3 to 60----- Not over 11.7-----	B. Edible eggs below B quality.	
IV-----	20	68.3 to 80----- Not over 11.7-----	B. Edible eggs below B quality.	

¹ Individual cases may contain not over 10 percent less A quality eggs than permitted for the lot: *Provided*, that the average for the lot is not more than the tolerance permitted in any grade. In lots of 200 cases or more, one case in each 10 examined may contain not over 20 percent less A quality eggs than is permitted in any grade.

² Within each tolerance for qualities below B, each of the grades may contain not over 3 percent Checks, and a combined total of not over $\frac{3}{10}$ percent Dirlties, Leakers, and Loss. Loss must not include inedible eggs. Individual cases of U. S. Export Grades I or A, II, III, and IV may contain not over 10 percent, 15 percent, 18 percent and 18 percent respectively, of qualities below B provided the average for the lot does not exceed the tolerance permitted in the grade.

The weight classes for U. S. Export Grades for Shell Eggs are the same as the weight classes for the Procurement Grades as indicated in table 7.

The Federal-State Grading Program

The United States Department of Agriculture offers a grading service to the egg industry that has become an important factor in marketing. The service is available on a voluntary and practically self-supporting basis.

The program provides for the cooperation of various State departments of agriculture and the extension services of the State colleges. Grade identification or grade labels in those States may use the phrase "Federal-State Graded."

Impartial grading and consistent and uniform interpretation of standards and grades together form the most important features for the success of Government grading. Whether grading is done in cooperation with a State agency or directly by the U. S. Government, it is referred to as "official grading."

The Federal-State Egg Grading Service is a cooperative arrangement between the U. S. Department of Agriculture and a State or other agency for the primary purpose of furnishing producers, processors, and others an impartial egg-grading service based on official national standards and grades. An agreement signed by the cooperating parties sets forth the procedures and methods to be followed in conducting the program. These services are operated on a voluntary basis and are supported almost entirely by fees charged the users. Cooperative agreements providing for the official grading of eggs are now in effect in 44 States.

Service to egg producers can be furnished more economically at the point of the first receiver or the assembly plant. To obtain grading service which provides for resident or continuous service at the packing plant, the applicant arranges with the officer in charge of the Federal-State Grading Service for the services of a grader trained to grade eggs according to official standards. This grader checks the accuracy of the quality determinations of the candlers and certifies that eggs bearing official identification are of the grade designated. This policy assures a maximum uniformity of grades of eggs marketed by the users participating in the service. Fees to be charged for any resident grading service are specified in the Regulations and cooperative agreements.

Resident graders classify eggs as consumer grades, procurement grades, and wholesale grades, or according to contract specifications. When eggs are classified as consumer grades to be packaged with official identification, each individual egg is candled for quality and sorted for weight by a licensed grader, or by a limited licensee. All eggs which are graded by a limited licensee are check-graded by a grader. Wholesale grades are usually determined by examining each egg in a representative sample out of each lot. The size of the sample depends on the number of cases and the uniformity or lack of uniformity in the lot. A 5-case sample is the minimum number of cases comprising a representative sample for a lot of 51 to 100 cases. From each sample selected, 100 eggs are examined. Procurement grades are generally graded on a representative sample basis. A lot may contain any quantity of one or more cases.

The grading services are also provided on a fee basis at a cost to the user of the service that is in relation to the time expended or the volume of eggs graded. Fee grading service may be provided at any place in the marketing channels.

The extent of the use of the service can best be illustrated by the fact that in the early part of 1961 approximately 319 firms were using the resident type of grading service for shell eggs. To officially identify eggs in one-dozen cartons, eggs must be candled and sorted by a licensed grader or a limited licensed candler whose work is checked by a grader. To any person possessing proper qualifications, there may be issued a limited license by the authorities to candle and grade eggs on the basis of the "United States Standards for Quality of Individual Shell Eggs," with respect to eggs purchased from producers, or eggs to be packaged with official identification. No person to whom a limited license is issued has the authority to issue any grading certificate.

Use and Growth of the Federal-State Egg Grading Service

Official grading of shell eggs is done extensively at shipping point assembly plants, and includes both wholesale carlot grading and grading of eggs packed in cartons of one dozen eggs each for direct distribution to retail stores. Grading for both purposes also is done in the terminal markets and to a limited extent at producer's premises. Egg handlers often request gradings of eggs in carlots and less than carlots, using the official grading certificates as an aid in making sales, or in learning the quality of a particular lot. When Government grading is used, the buyer knows what he is buying without seeing it. Buyers, therefore, have more confidence when making their purchases, and producers and shippers have an expert, unbiased appraisal and certification of quality in offering eggs for sale when they are officially graded.

When disputes arise between buyer and seller the shipper, as well as the receiver, has recourse to an official grading of the eggs at terminal markets as part of the Federal-State grading service.

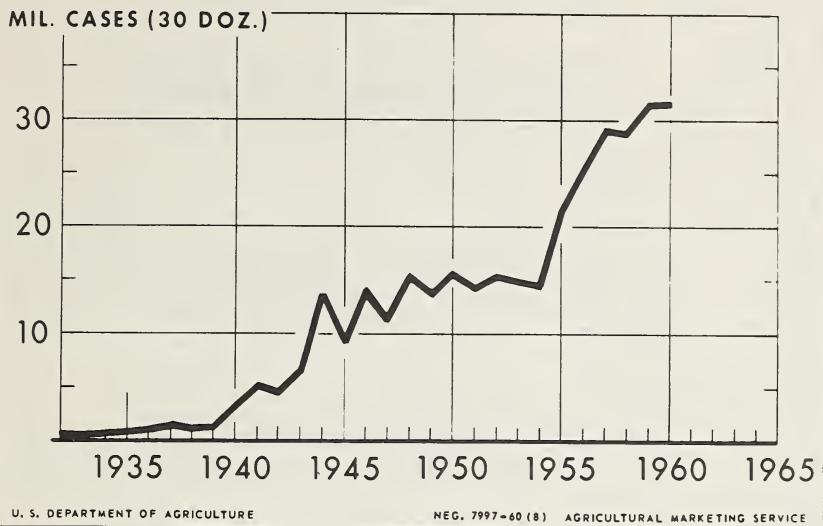
At storage warehouses, eggs are often graded by Federal-State graders before they are placed in storage and as they leave the warehouse. Official egg quality standards and weight classes are used as a basis for spot and futures trading on the Mercantile Exchanges of Chicago and New York.

Eggs purchased on contract by private institutions, such as hotels, hospitals and steamship lines, are frequently graded by Federal-State graders and usually in terminal markets. The grading service is also used by the Veterans' Administration and our Armed Forces.

Table 9 shows the progressive changes in volume of eggs graded under Federal and Federal-State grading programs and the relation to farm sales of shell eggs available for market for the years 1940 to 1960.

It is interesting to note the growth of the service by comparing the volume and the percentage of shell eggs officially graded in the past with more recent volume figures. Prior to World War II, less than 2 percent of sales available for market were graded under these programs. The most rapid expansion occurred during World War II in connection with Government buying programs for the Armed Forces (fig. 1). The use of the services and the volume of products inspected and graded continued to expand after the cessation of hostilities. This expansion was due in part to the fact that firms had had experience

SHELL EGGS GRADED UNDER FEDERAL-STATE PROGRAM



U. S. DEPARTMENT OF AGRICULTURE

NEG. 7997-60 (8) AGRICULTURAL MARKETING SERVICE

FIGURE 1.—The quantity of shell eggs graded under Federal-State programs increased from 5 million cases in 1941 to more than 30 million cases in 1960.

with Federal-State grading and inspection programs and were continuing to use them in their processing and marketing programs. In 1960, there were 30,157,851 cases officially graded, which was about 22 percent of farm sales available for market.

The State of Minnesota in its Federal-State Grading Program for Shell Eggs ranks first in volume of grading services rendered with 5,406,822 cases graded during 1960; Iowa second, with 4,431,803 cases graded; Ohio third, with 3,235,957 cases graded; Texas fourth, with 1,557,827 cases graded; and Wisconsin fifth, with 1,502,912 cases graded. Table 10 gives the production and sales by farmers and the volume of shell eggs officially graded by States during the year 1960.

Although the volume of eggs graded under Federal and Federal-State programs is still relatively small in relation to sales of eggs available for market, the influence of Federal grades is far greater than the volume data indicated. Most of the recent State egg laws and the revisions of the older laws are concerned principally with grading, grade labeling, and accurate description of the product to the consumer at the retail level. The new Iowa egg grading law, for instance, requires that all eggs purchased direct from producers, except those used in hatching baby chicks and those sold by a producer to a consumer from his own flock, must be candled and graded according to USDA Standards for Individual Shell Eggs, and all eggs sold to consumers at retail must be sold according to USDA Consumer Grades.

Egg Grading and Marketing Schools

The Poultry Division of the U. S. Department of Agriculture cooperates with the Northeastern Poultry Producers Council and the

TABLE 9.—*Eggs: Production and sales by farmers, and shell eggs graded under Federal and Federal-State grading programs, 1940-60*

Year	Produced on farms ¹	Farm sales use ¹			Graded	Percentage graded ²
		1,000 cases ³	1,000 cases ³	1,000 cases ³		
1940	110,297	3,640	6,114	77,013	3,322	4.31
1941	116,372	4,594	11,251	78,074	5,055	6.47
1942	135,028	5,368	26,936	80,899	4,647	5.74
1943	151,519	6,611	32,560	90,604	6,694	7.39
1944	162,603	5,325	41,441	93,406	13,696	14.66
1945	156,169	6,616	18,175	109,556	9,307	8.50
1946	155,450	5,199	21,019	107,526	14,096	13.11
1947	153,844	5,212	18,199	110,003	11,334	10.30
1948	152,497	5,214	13,390	114,460	15,129	13.22
1949	155,983	6,085	15,671	115,138	12,804	11.12
1950	163,761	6,078	18,578	120,187	15,507	12.90
1951	161,286	7,195	10,614	126,238	14,232	11.27
1952	161,300	6,913	9,932	127,624	16,291	12.76
1953	160,811	7,233	10,682	127,110	13,831	10.88
1954	163,703	7,383	12,102	128,615	17,442	13.56
1955	165,350	7,633	11,778	130,631	24,529	18.78
1956	163,758	8,540	12,074	134,730	26,684	19.81
1957	169,517	8,403	12,331	135,302	29,220	21.60
1958	171,130	9,580	12,172	136,859	30,159	22.04
1959	175,931	9,330	17,754	137,024	30,053	21.93
1960	170,492	9,615	14,746	135,625	30,158	22.24

¹ Compiled from statistics of Agricultural Marketing Service.² Percentage of sales available for market.³ A case contains 30 dozen eggs.⁴ Preliminary.

TABLE 10.—*Shell Eggs: Production and sales by farmers, and shell eggs officially graded, by States*

ANNUAL 1960

State and Division	Eggs produced	Eggs sold	Eggs officially graded
	<i>Cases</i>	<i>Cases</i>	<i>Cases</i>
Maine	2,091,666	2,066,666	112,398
New Hampshire	897,222	886,111	186,849
Vermont	452,777	427,777	
Massachusetts	1,833,333	1,816,666	546,540
Rhode Island	208,333	205,555	4,766
Connecticut	1,825,000	1,802,777	179,724
New York	5,177,777	5,016,666	929,370
New Jersey	5,588,888	5,555,555	(¹)
Pennsylvania	9,688,888	9,416,666	1,315,784
North Atlantic	27,763,884	27,194,439	3,275,431
Ohio	6,863,888	6,488,888	3,235,957
Indiana	6,986,111	6,700,000	1,320,227
Illinois	6,658,333	6,294,444	1,262,983
Michigan	3,997,222	3,761,111	462,263
Wisconsin	5,458,333	5,069,444	1,502,912
East North Central	29,963,887	28,313,887	7,784,342
Minnesota	9,866,666	9,394,444	5,406,822
Iowa	13,144,444	12,491,666	4,431,803
Missouri	4,725,000	4,194,444	491,925
North Dakota	1,155,555	997,222	35,278
South Dakota	4,111,111	3,919,444	567,442
Nebraska	5,130,555	4,788,888	604,328
Kansas	3,719,444	3,358,333	229,685
West North Central	41,852,775	39,144,441	11,767,283
Delaware	369,444	361,111	2,367
Maryland	908,333	850,000	275,737
Virginia	3,038,888	2,733,333	1,098,864
West Virginia	1,069,444	947,222	
North Carolina	5,652,777	4,991,666	340,923
South Carolina	2,261,111	2,033,333	55,927
Georgia	6,161,111	5,888,888	123,765
Florida	2,861,111	2,791,666	203,951
District of Columbia			595,665
South Atlantic	22,322,219	20,597,219	2,697,199
Kentucky	2,466,666	1,930,555	1,392
Tennessee	2,658,333	2,141,666	169,832
Alabama	3,622,222	3,291,666	120,137
Mississippi	3,230,555	2,872,222	854,001
Arkansas	2,472,222	2,211,111	83,045
Louisiana	1,413,888	1,205,555	196,286
Oklahoma	1,694,444	1,413,888	3,730
Texas	6,733,333	6,136,111	1,557,827
South Central	24,291,663	21,202,774	2,986,250

TABLE 10.—*Shell Eggs: Production and sales by farmers, and shell eggs officially graded, by States*—Continued

ANNUAL 1960

State and Division	Eggs produced	Eggs sold	Eggs officially graded
Montana	Cases 566, 666	Cases 477, 777	Cases 52
Idaho	741, 666	663, 888	426
Wyoming	158, 333	127, 777	
Colorado	766, 666	661, 111	331, 260
New Mexico	375, 000	336, 111	32, 430
Arizona	447, 222	436, 111	9, 557
Utah	861, 111	825, 000	1, 982
Nevada	33, 333	25, 000	
Washington	2, 911, 111	2, 786, 111	579, 146
Oregon	1, 663, 888	1, 569, 444	28, 038
California	15, 772, 222	15, 625, 000	664, 455
Western	24, 297, 218	23, 533, 330	1, 647, 346
United States	170, 491, 646	159, 986, 090	30, 157, 851

¹ Eggs officially graded in New Jersey reported under Pennsylvania.

NOTE.—A case contains 30 dozen eggs or 360 eggs.

Southeastern Poultry and Egg Association in conducting egg grading and quality schools during the month of June. The sites of the schools are rotated each year. The schools have become of national interest and egg candlers and egg room supervisors come from many parts of the country to attend. The teaching staffs are made up of practical businessmen, teachers, and officials with years of experience.

New Developments in Egg Quality Standardization

The rapid increase in the number of large laying flocks has opened the door for the commercial development of new and better ways of standardizing shell egg quality and to more accurate and objective ways of determining and certifying that quality.

The "Quality Control" egg grading program developed and administered by the Poultry Division provides for Government certification of the quality of eggs which are produced and marketed under controlled conditions. The quality control factors specified include uniformity in age of laying flocks, constant temperature and humidity levels, and promptness in handling. Interior quality of such eggs is measured by a test which involves breaking representative samples and measuring the height of the albumen (thick white). Eggs handled according to these requirements and meeting the established quality standards are eligible for either the U. S. Grade AA label or the new grade label designation, "Fresh Fancy Quality." As of April 1961, 30 egg packaging firms have been officially installed in the quality control program. Their plants are located in 18 different States: New York, Pennsylvania, New Jersey, Ohio, Indiana, Illinois, Michigan, Minnesota, Iowa, Missouri, North Dakota, Nebraska, North Carolina, Georgia, Mississippi, Texas, Colorado and

Washington. This egg grading program is described in detail in AMS-246, "Equipment and Methods for Measuring Egg Quality."

Another advantage of the program is its adaptability to the mechanized methods of egg handling which are developing so rapidly, including the systems designed to use electronic blood-spot detectors and other mechanical selection devices.

Federal-State Grade Labels

Eggs may be marketed in accordance with USDA grade, either in cases or in cartons. When cartoned eggs are officially graded, the grade mark is printed on the carton or on a label used to seal the carton. The U. S. grade, weight or size, date of grading and plant number are indicated within the grade mark, on the tape used to seal the carton, or on the carton. When the grade mark is printed on a tape used to seal the carton automatically, the size or weight class of the product may be shown on the main panel of the carton, rather than within the grade mark, and in such instances the form of the grade mark is as indicated in figure 3.

The Federal-State "Quality Control" egg grading program permits the use of either the Fresh Fancy Quality label or the U. S. Grade AA shield on top quality eggs (fig. 4).

Eggs meeting the standards of U. S. Grade A quality also may be marketed under the controlled quality program. Whichever grade shield is used—Fresh Fancy Quality, U. S. Grade AA, or U. S. Grade A—it may be accompanied by the boxed statement: "Produced and Marketed under Federal-State Quality Control Program."

Cartons carrying the "Fresh Fancy Quality" grade mark must also show the size of the eggs, on the basis of U. S. official egg sizes, and a "pull" date of not more than 10 days from the date of testing.

The U. S. grade mark, whether it appears on a carton or on a case of eggs, gives the consumer an assurance of the quality as stated. It also helps consumers to judge relative values more accurately and also to adapt their purchases to appropriate uses, thereby getting more for their money.



FIGURE 2.—Official grade mark for cartons or seals on cartons holding 1 dozen eggs.



FIGURE 3.—Official grade mark for use on carton seals when size is shown on carton.



PRODUCED and MARKETED
under FEDERAL - STATE
QUALITY CONTROL PROGRAM

PRODUCED and MARKETED
under FEDERAL - STATE
QUALITY CONTROL PROGRAM

FIGURE 4.—Either the "Fresh Fancy Quality" shield (left) or the "U. S. Grade AA" shield (right) may be used on cartons or seals to identify eggs marketed under the quality control program.

Private institutions, such as hotels, hospitals, and steamship lines, can be assured of getting the quality, size, and class of eggs they desire by using the ACCEPTANCE TYPE of Federal-State grading service. This type of service is available in every State. Arrangements may be made for ACCEPTANCE TYPE of service by applying to USDA poultry grading offices located in any of the larger cities.

Buyers can have their egg purchases inspected according to their specific requirements. Where poultry and eggs are bought on a contract basis each case is stamped to show that the delivery is acceptable. An example of an acceptance stamp is shown at right in figure 5.



FIGURE 5.—Official mark to indicate acceptance under institutional purchase contracts.

PART II

EGG PRODUCTS

One of the best ways of preparing eggs for large volume users is by removing the contents from the shell and preserving the whites, yolks, or mixtures of the two by freezing or drying. Frozen eggs and dried eggs have certain advantages over shell eggs for manufacturing use, especially in large-scale production. Shell eggs are bulky and fragile, and require careful handling when packing for shipment and storage. Shell eggs are also perishable, even under good storage conditions. When frozen or dried, they provide the manufacturer with a more uniform product, which is compact and may be held with much less deterioration.

Need for Standardization

In the early days of the frozen egg industry, the canning of eggs served as a means of disposing of eggs unsuitable for shipment and storage as shell stock; that is, dirty, cracked, thin-shelled, or undersized eggs. Although the development of the freezing process offered

a byproduct outlet for eggs which otherwise were nearly a total loss, the use of poor-quality breaking stock prepared under unsanitary conditions retarded early progress of the industry.

The U. S. Bureau of Chemistry, in 1916, was probably responsible for starting this industry on its way to success by setting rigid standards of inspection. In 1939, the Federal Food and Drug Administration established standards of identity for egg products.

During and following World War II, the U. S. Department of Agriculture purchased considerable quantities of dried eggs on the basis of percent solids, percent fat, and solubility and palatability scores. The Armed Services, as well as many of the large commercial users, have their own purchase specifications for frozen and dried eggs.

The U. S. Department of Agriculture had not issued standards and grades for egg products at the time of publication of this bulletin, although numerous studies and conferences had been devoted to their development. Industry opinions were that there are numerous problems in the field of production, distribution, and particularly functional performance, which warrant additional research before standards and grades are issued.

One difficulty in setting up standards which are fair and workable for the processor and agreeable to the purchaser is that frozen and dried eggs have many "intangible" quality factors and functional properties which are difficult to specify in a manner that would meet the needs of all users. Other frozen foods or fruits have normal color, defects, and characteristics which can be seen or counted. A problem exists as to what would be an acceptable bacterial count for each of the various products, considering the variable requirements of the different users. There are also differences of opinion as to what quality factors should be considered in standards and their economic significance.

Inspection Program

For many years, the Poultry Division in the U. S. Department of Agriculture has been working with industry in providing inspection services concerning sanitary requirements and operating procedures in egg processing plants and certification on that basis.

When plants manufacture and package egg products under the continuous supervision of a USDA licensed inspector, the entire processing operation is checked for adequacy of facilities, sanitation of equipment and operating procedures, types of raw material (breaking stock) used, and the finished egg products. When the inspection service is used in plants that manufacture egg products, the "Regulations Governing the Grading and Inspection of Egg Products" are applicable.

The production of liquid egg processed in approved plants under continuous Federal supervision in 1960 totaled 467,168,664 pounds, which was approximately 80 percent of the total production. The approximate number of processors using the resident inspection service for egg products is 102. Table 11 gives the volume of liquid egg processed and the volume under Federal supervision for the years 1951 to 1960.

In some instances, frozen and dried eggs are inspected for condition in terminal markets. Egg products which are prepared in nonofficial plants may not be officially identified. However, such products may be inspected organoleptically and by laboratory analysis and covering

TABLE 11.—*Volume of liquid egg processed in approved plants under Federal supervision, by years, 1951-60*

Year	Production ¹	Under Federal supervision	Percentage supervised
	<i>1,000 pounds</i>	<i>1,000 pounds</i>	<i>Percent</i>
1951	408, 654	285, 337	69. 82
1952	382, 394	241, 558	63. 17
1953	411, 274	272, 762	66. 32
1954	465, 701	325, 895	69. 98
1955	453, 435	348, 492	76. 86
1956	464, 855	341, 349	73. 43
1957	474, 730	346, 590	73. 01
1958	480, 798	354, 732	73. 78
1959	701, 320	528, 684	75. 38
1960	582, 466	467, 169	80. 21

¹ Compiled from statistics of Agricultural Marketing Service.

certificates issued setting forth the results of the inspection. Such certificates apply only to samples examined and include a statement that the product was produced in a nonofficial plant. Frozen whole eggs are drilled and examined organoleptically and if the product appears to be satisfactory, samples are taken for laboratory analyses. The samples are examined for direct microscopic bacterial count and for the presence of acetic and lactic acid.

Summary of Plant Facilities and Operating Requirements

There are four important considerations in the production of satisfactory egg products. They are: (1) wholesome breaking stock; (2) temperature control; (3) sanitation; and (4) chemical changes. The Regulations Governing the Grading and Inspection of Egg Products, issued by the Poultry Division of the Agricultural Marketing Service, cover the minimum requirements in detail.

Only eggs suitable for human consumption may be incorporated in the frozen or dried egg products produced under USDA supervision. The eggs are candled to remove inedible eggs and to sort out the soiled eggs, cracks, and leakers. The edible clean eggs are sent immediately to the breaking room. Each shell egg must be broken in a satisfactory and sanitary manner and inspected for wholesomeness by smelling the shell or the egg meat and by visual examination at the time of breaking. All egg meat is reexamined by a limited licensed inspector before being emptied into the tank or churn.

Temperature controls are necessary at all points in the production of egg products because the raw material is an ideal medium for the growth of bacteria, which are always present in spite of any precautions.

The provisions governing sanitation concern the operating procedures, facilities (including the grounds around the plant), building construction, equipment, and toilet facilities. The general theme of the provisions is to minimize the number of bacteria in the product through all stages of production.

The kind of metals used which come in contact with the product and the cleaning agents used must be such that chemical changes in the product are prevented. Regularity of cleaning equipment is required.

Labeling

Plants operating on a voluntary basis as official plants under Government supervision may have their products identified with the official inspection mark (fig. 6), or by an official mark of rectangular design (fig. 7), depending on the type of shell eggs broken for the preparation of the products.



FIGURE 6.—The official inspection mark.

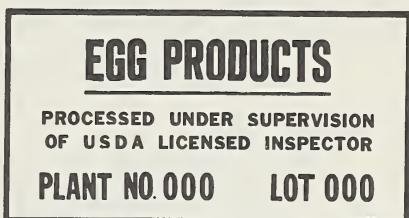


FIGURE 7.—An official mark of rectangular design.

The official plant may request a certificate on an individual lot of their product for any specific factor that a purchaser may request. A nominal charge is made for each type of examination.

Labels on which official identification appears must be approved. The label must contain the common or usual name of the product and the name and address of the packer or distributor. When the name of the distributor is shown, it must be qualified by such term as "packed for," "distributed by," or "distributors." The label also must bear the lot number and a statement of the net contents of the container. If the product is comprised of two or more ingredients, the ingredients must be listed, and listed in the order of descending proportions.

PART III

ADMINISTRATION OF PROGRAMS

All grading and inspection work on poultry and eggs and their products is administered by the Poultry Division of USDA's Agricultural Marketing Service.

The Poultry Division consists of a Program Analysis Group, an Inspection Branch, a Grading Branch, and a Standardization and

Marketing Practices Branch. The Standardization and Marketing Practices Branch is responsible for developing regulations, standards and grades which are administered by the Inspection and Grading Branches. While the responsibility lies primarily with the Standardization and Marketing Practices Branch, the Poultry Division, through the Director's office, is constantly working toward the development of program aids for training graders to recognize quality factors in poultry and eggs and their products. A home economist is employed to develop educational material for consumers. This Branch also develops standards for poultry and egg containers and carries on work to encourage improved marketing practices.

The Poultry Division maintains four area offices—located in Philadelphia, Chicago, Des Moines, and San Francisco—for supervising the work of grading at the field level. In each office, there is an Area Supervisor for Grading and, varying with the workload, Assistant Area Supervisors. These technical people work with Federal-State employees in the field directly and through Federal-State Supervisors.

Area Supervisors—Poultry and Egg Grading

(1) WESTERN AREA:

Room 203,
180 New Montgomery Street,
San Francisco 5, Calif.

Phone: YUKon 6-3500, X-3494 and 3495.

States supervised: Arizona, California, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming.

(2) EAST MIDWEST AREA:

Room 1117, U. S. Customs House,
610 South Canal Street,
Chicago 7, Ill.

Phone: HArrison 7-6910, X-338 and 339.

States supervised: Alabama, Arkansas, Illinois, Indiana, Kentucky, Louisiana, Michigan, Mississippi, Missouri, Ohio, Tennessee, Wisconsin.

(3) WEST MIDWEST AREA:

Room 503, Iowa Building,
Des Moines 9, Iowa

Phone: CHerry 3-2171, X-474 and 475.

States supervised: Colorado, Iowa, Kansas, Minnesota, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas.

(4) EASTERN AREA:

Room 1006, Customs Building,
2d and Chestnut Streets,
Philadelphia 6, Pa.

Phone: MArket 7-6000, X-482 and 483.

States supervised: Connecticut, Delaware, Florida, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, West Virginia.



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