United States

Department of Agriculture

Agricultural Marketing Service

Fruit and Vegetable Division

Processed Products Branch

Grading Manual for Canned Pumpkin and Canned Squash

Effective August 1956

This manual is designed for Processed Products Branch Personnel of the U.S. Department of Agriculture. Its purpose is to give background information and guidelines to assist in the uniform application and interpretation of U.S. grade standards, other similar specifications and special procedures.

The citation of any data, criteria, techniques, illustrations, copyrighted material, or pictorial representation accredited to private authorship is used with the permission of the individuals or sources cited. Unless a specific reference is cited, the information in this manual has been compiled or developed from sources available to the public as well as from technical knowledge of personnel in the Department.

Following the suggested guidelines in this manual does not excuse failure to comply with the Federal Food, Drug, and Cosmetic Act or any other applicable Federal or State laws or regulations.

Except for official USDA inspection aids or devices and color guides (or standards) produced under license of the Department, the mention of any supplier, patented device, product, brand name or equipment does not imply endorsement by the Department over any other similar, or equally effective material.

Address inquires to:

Chief, Processed Products Branch
Fruit and Vegetable Division, AMS
U.S. Department of Agriculture
P.O. Box 96456, Rm. 0709, South Building
Washington, DC 20090-6456

Reprinted April 1994

TABLE OF CONTENTS

Page No.

I. GENERAL.

A. Purpose and Scope.

The instructions contained herein explain and furnish technical information which will serve as a guide in the inspection of canned pumpkin and canned squash and will aid inspectors in attaining uniformity in applying the United States grade standards and in the proper certification of the product. These instructions will also serve to familiarize the inspectors with the commercial product of canned pumpkin and the general procedure used by the industry.

B. Caution.

Inspectors are reminded that these are administrative instructions for their use only and not for public distribution.

C. Keep Instructions Current.

These instructions may be revised, in whole or in part, whenever the need for such revision is indicated. Therefore, any comments or suggestions such as detection of errors or the development of new and better inspection techniques should be forwarded in detail to the Washington office.

II. PRODUCTION.

A. Annual Pack.

The quantity of canned pumpkin and squash in 1952 exceeded 4,000,000 actual cases, ranking eighth among vegetables for canning. The average yearly pack is normally around 2,000,000 actual cases.

B. Packing Areas.

The principal producing areas of canned pumpkin and squash are Illinois, Indiana, New York, Maine, Minnesota, California, Washington, and Oregon.

C. Varieties.

The names pumpkin and squash are propularly applied to the fruits of the species of the genus Cucurbita, namely C pepo, C maxima and C moschata. In general, the term **pumpkin** is applied to the late maturing or **fall** varieties of C pepo and C maxima. The principal varieties of C pepo and C. maxima used for canning are the Connecticut field pumpkin, Dickinson pumpkin, Kentucky field pumpkin, the Boston marrow squash, and the Golden Delicious squash.

D. Harvesting.

Pumpkin and squash should not be harvested for canning until fully matured. Harvesting is usually done after the leaves begin to turn yellow. Mature pumpkin or squash have a hard rind which can be dented only with difficulty with the thumbnail. If picked too green the under portions of the pumpkin will have a greenish color and this may be carried over into the finished product. Pumpkin and squash are usually harvested starting approximately September 15 in the Midwest and Northeast States, and October 1 in the Pacific Northwest.

III. PREPARATION AND CANNING.

A. Receiving.

Pumpkin and squash are usually delivered as harvested and stored at the cannery until used. Well-matured pumpkin or squash will keep for several weeks if stored in a well-ventilated place. In some areas it may be necessary to store them in an enclosed shed for protection against freezing. Normally no inspection is made of pumpkin or squash received by the plants.

B. Washing.

Whole pumpkins or squashes are fed by hand or conveyed into a combined tank and spray washer, consisting of a rotary drum partially submerged in a tank of water. The combined soaking and rotary motion loosens adhering dirt which is removed by strong sprays of water. Grit sometimes becomes embedded in the rind, necessitating thorough washing.

C. Trimming.

From the washer the pumpkins or squashes pass to the inspection belt where stems are knocked off by hand and blossom ends, scar tissue rot, and other blemishes are trimmed out.

D. Cutting.

In some canneries the trimmers also cut the pumpkin or squash into halves or quarters with long knives and scrape out the seeds and stringy pulp by hand. In many plants mechanical cutters are used into which the whole units (or halves) are fed by conveyor cutting the units in pieces. Strong sprays of water help to knock out most of the seeds, which drop from the cutter through small perforations.

Where the units are cut and the seeds and pulp removed in separate operations, the cut pieces pass to a revolving drum where they are tumbled under strong sprays of water which remove most of the seeds and pulp.

Where seeds are to be saved for planting, they may undergo further washing to separate them from the pulp.

Cut pieces are in some cases passed over an inspection belt where imperfect pieces and internal rot, not visible from the outside, may be picked out by hand.

E. Wilting (Steaming).

The cut pieces are cooked in live steam until they are tender all the way through. The length of time necessary depends upon the size of the pieces and the nature of the equipment in which the steaming is done. The following are examples in which the wilting or steaming may be accomplished:

1. In metal baskets in retorts, either under pressure or at atmospheric pressure.

2. In continuous metal box wilters. The pieces are carried through on a continuous belt and are subjected to live steam.

3. In wilting towers. These are tall cylindrical silo-like structures into which the cut pieces are fed continuously at the top by conveyor and removed at the bottom by a screw conveyor. The pumpkin or squash is continuously treated with live steam as it passes through the wilting tower.

F. Pressing.

The wilted pumpkin or squash is soggy with liquid which is a mixture of condensed steam and pumpkin or squash juice. The product is treated to remove excess liquid in order to attain the desired consistency in the canned product. This is done by putting the wilted pumpkin or squash through an adjustable press. In certain plants the pressing and wilting is done simultaneously by the use of augers inside of cone-shaped perforated screens.

G. Pulping.

The pressed pumpkin or squash goes to the pulper or cyclone to remove hard particles, pieces of stems, seeds, fiber, and other extraneous material. In some cases the product is first put through a coarse, heavy cyclone to remove the bulk of extraneous material and an ordinary cyclone to reduce the size of the particles. For the latter a screen with perforations 1/8 inch in diameter is commonly used.

Some processors use what is commercially known as a Fitz mill. This machine constructed with hammer and knive edges on opposite sides reduces or pulps pumpkin by a combined impact mashing action.

H. Finishing.

From the pulper the product goes to the finisher which removes the finer bits of seeds or other material and gives the final product the desired physical character. There is a difference of opinion among canners as to the most desirable size of the particles of pumpkin in the finished product. Some prefer a very smooth product which can be obtained by using a very fine finisher; others feel that the canned pumpkin or squash should have a noticeable amount of grainy structure and, therefore, use a finisher that is relatively coarse.

I. Preheating.

The filling temperature of the prepared pumpkin or squash is an important part of processing. Heat penetration of the product is very slow because of its physical character, and the temperature at the beginning of the process is correspondingly important. By use of the preheater, it is possible to fill all of the cans at a uniform high temperature.

The preheater is usually a straight piece of pipe surrounded by a larger pipe. The product is pumped through the smaller internal pipe and the space between the two pipes is filled with steam, the temperature of which can be controlled. The rate of flow of the product through the pipe and the temperature of the steam determines the temperature at which it goes to the filler. The preheater normally raises the temperature of the product to 190-200 degrees F. To prevent scorching the preheater is usually constructed so that it will shut off automatically if, for any reason, the flow through the inside pipe is stopped.

J. Filling.

The hot pumpkin or squash goes directly to the filler and into cans. If the thickness of the product at this point is too great, the product may not be handled properly by the filler. If, for any reason, the filler or closing machine is forced to stop for any length of time all of the pumpkin material should be put back with the material going though the preheater.

Pumpkin or squash has a corrosive action on tin-plate and should be packed in enamel lined cans. It is important to fill the cans completely so that the product is in contact with the entire inner surface of the cover when the can is sealed. Even a small headspace may result in some discoloration after processing.

K. Processing.

The filled cans should be processed promptly. High closing temperature may be off-set by undue delay between closing and starting of the process time. A partially filled crate of cans should be sent at once to the retort rather than awaiting any time for additional cans.

L. Cooling.

Prompt and adequate cooling is especially important since canned pumpkin has a slow heating and cooling rate. Failure to cool the product promptly may result in over cooking and loss of color and may be directly responsible for spoilage by thermophilic bacteria.

Cooling is usually accomplished by moving the metal retort baskets through a long tank of water by means of an overhead endless chain. The speed of the chain is regulated according to the degree of cooling desired. Cold water is kept continuously flowing into the tank to hold down the temperature. Immediately after cooking, while the cans are distended by heat and internal pressure, minute openings in the double seams may be present. Cooling water contaminated with bacteria may be drawn through seam openings as pressure in the cans is replaced by vacuum; therefore, water in the cooling tank should be kept clean. Some canners cool by means of a water spray in order to reduce the contamination hazard.

IV. INSPECTION OF THE PRODUCT.

A. Sampling.

It is equally as important to draw representative samples as it is to accurately examine and classify the samples as to quality. Make sure that the best possible sampling job has been done so that the samples will represent the lot which is being inspected. The sampling rates prescribed in the Rules and Regulations and in other Inspectors' Instructions and Memorandums should be followed when drawing samples for the inspection of canned pumpkin or squash. Pertinent information with respect to the product should be recorded on the sampling certificate, such as condition of containers, cases, location of the lot, and all means of identification in the event that it will be necessary to supervise the loading of the lot.

B. Inspection Equipment.

The following lists comprise the minimum equipment and supplies needed for inspection of canned pumpkin or squash:

1. Equipment for Grading.

a. Grading scale - 1/4 ounce graduations.

b. Vacuum gauge.

c. Can opener.

d. Beer can opener.

e. Trays - white, shallow (about 10" x 14").

f. Trays - white, deep (about 10" x 14").

g. Plastic ruler.

2. Supplies for Grading.

a. Folder containing:

(1) United States grade standards and the Federal specifications for canned pumpkin and canned squash.

(2) Grading Manual for Canned Pumpkin and Canned Squash and any supplemental instructions.

(3) Sampling sheets.

(4) Score sheets.

(5) Towels.

(6) Marking pen.

(7) Sampling stamp.

C. General Inspection Procedure.

The United States Standards for Grades of Canned Pumpkin and Canned Squash describe and establish requirements for the quality factors as accurately as it has been possible to do. In order to uniformly apply the standards, however, it is necessary for each inspector to be guided by their supervisor when there is any doubt as to the correct interpretation of any requirement. This is particularly important whenever unusual conditions are encountered or when an error in the interpretation of a requirement will change the product from one grade to another. Quality requirements which involve judgement as to the extent to which the appearance and eating quality are affected should always be checked with your supervisor, unless you are sure you are applying the proper interpretation. Supervisors should make sure their judgement is in line with Regional supervisor's and the Washington office.

D. Setting Up The Score Sheet.

Record all important information concerning the inspection on the score sheet in addition to the packer's name, date, and inspector's signature; this also includes such information as netweights, size and kind of containers, vacuums, packer's code numbers or marks that are present, and all significant information taken from the labels.

E. Net Weight.

The net weight of the product means the weight of the pumpkin or squash less the weight of the container. Record the net weight for each container.

F. Fill of Container.

Prior to observing the fill of container, vacuum readings should be taken. Normally there is very little headspace found in canned pumpkin or canned squash since even a small headspace may result in some discoloration after processing. When it appears that the headspace is excessive or close to the 10 percent of the volume of the container, the headspace should be measured with the headspace gauge.

G. Grade Factors Which Are Not Scored.

1. Normal Flavor and Odor.

Normal flavor and odor is required in each grade above Substandard. The percent total solids and variety may cause flavor variations but only objectionable flavor are important. When the canned pumpkin or canned squash definitely possesses an objectionable flavor or odor such as scorched or bitter taste, the product should be classified as Substandard.

H. Grade Factors Which are Scored.

1. Consistency.

The factor of consistency should be scored immediately after emptying the product from the container. Prior to emptying the product from the container the temperature should approximate 68 degrees Fahrenheit. To empty the product from the container completely remove one end of the container, placing the opened end down on a flat surface, using a beer can opener or vacuum gauge puncture several holes in the unopened end to release the vacuum present and vertically slide the can cylinder off the product.

Do not touch or adjust the settling of the product. At the end of two minutes measure the highest point of the mound to the flat surface of the tray. A thin plastic ruler may be used for this purpose. To measure the free liquor that separates from the product, tilt the tray slightly and pour or lift by pipette the liquor which separates.

The requirements for good consistency are outlined in the grade standards and it should not be necessary to repeat them here.

Canned pumpkin or squash to meet the requirement of **fairly good consistency** when emptied from the container should not level off completely in two minutes and not more than 30 cc of free liquor should separate from the product for each 30 ounces of net contents.

2. Color.

The color of the product may vary considerably because of the various methods of processing and maturity. In rating this factor keep in mind (1) uniformity; (2) brightness, and (3) is the color typical of a well matured pumpkin or squash for the variety. Immature pumpkin or squash, overcooking or other improper processing, such as stackburn, may cause poor color. To score in the Grade A classification the canned pumpkin or canned squash should have a uniform bright color. Lots may differ in color provided they are typical of a product prepared from well matured pumpkin or squash.

Canned pumpkin or squash which has a greenish-yellow or greenish-orange tint typical of squash not fully matured or is dull, slightly tan or slightly gray in color should be scored as meeting the requirements of **fairly good color**. Canned pumpkin or canned squash that fails the requirements for **fairly good color** should be scored Substandard.

a. Explanation of Plastic USDA Color Guides.

Inspectors are cautioned that these color guides are minimum color allowed in each color classification and these guides **will not always** match the more intense, rich colors of canned pumpkin.

(1) **USDA Color Guide No. 1 (Fancy Color)** illustrates the minimum color which would be considered Canned Pumpkin or Canned Squash prepared from **well matured** pumpkin or squash.

To score in the "A" classification for color the canned product must possess a practically uniform bright color typical of canned pumpkin or canned squash prepared from well matured pumpkin or squash.

Color No. 1 illustrates the minimum orange color allowed (or bottom limit) in the "A" color classification. When the sample is bright in color and is equal to or better (as much or more orange and less green) than USDA color Model No. 1 the product should be scored in the "A" classification for color. Color alone is not a limiting rule in the "A" classification.

(2) **USDA Color Guide No. 2 (Standard Color)** illustrates the minimum color which would be considered Canned Pumpkin or Canned Squash prepared from **fairly well matured** pumpkin or squash.

To score in the "C" classification for color the canned product must possess a color typical of fairly well matured pumpkin or squash and may possess a slight tinge of gray or tan color, may be variable or slightly dull but not to the extent that the appearance or eating quality is materially affected.

Color No. 2 illustrates the minimum orange color (or bottom limit) which would be allowed in the "C" classification. When the sample is no more than slightly dull in color and is equal to or better (as much or more orange and less green) than USDA color Model No. 2, the product should be scored in the "C" classification for color.

(3) Samples that are dull in color and are not as good in

color (less orange and more green) as No. 2 are classified as Substandard in color.

(4) How to Use the USDA Color Guide for Canned Pumpkin and Canned Squash.

(a) Pour a mound of the canned pumpkin or canned squash on a flat tray. The mound should be thick enough so that no light is reflected through the product from the bottom of the tray.

(b) Place the color guide on the canned pumpkin or canned squash, shiny side up, and push down so that the surface of the product and the guide are about on the same plane.

(c) To eliminate texture, place a piece of colorless clear plastic or glass beside the color guide in a manner so that approximately the same area of the guide and the product under the plastic may be observed side by side and under the same conditions.

(d) Make the observation under the best conditions of lighting that are available, preferable under constant laboratory lighting that approximates diffused north daylight (about 7500 degrees Kelvin).

(5) Direction for Care of Color Guides.

The color guides -- No. 1 and No. 2 -- are made of plastic and should be handled carefully to avoid scratching. The color guides should be cleansed immediately after using with water and a mild soap. The surfaces may be further cleaned and dried with a soft cloth. No abrasive cleaner should be used. It is suggested that they be replaced in the protective envelope and be stored in the box that is furnished with each set of color comparators. They should be covered and stored in a cool dark place when not on display or in actual use.

(6) One set of plastic color comparators (No. 1 and No. 2) is located at each Processed Products Inspection Office.

3. Finish.

To determine the finish, smooth a portion of the product with a spatula or knife to see that a smooth surface results. Observe the fineness of the particles and freedom from hard or lumpy pieces. To meet the requirements of **good finish** the pumpkin or squash particles should be evenly divided, fine grained, smooth but not pasty, and the pumpkin or squash particles are tender.

Canned pumpkin or squash of which the particles are slightly coarse or

slightly pasty should be scored as meeting only **fairly good finish**.

A product which is definitely pasty or the particles are definitely hard or definitely coarse should score in the Substandard range for the factor.

4. Defects.

The determination of the score for defects should be made after the contents have been evenly spread on a flat white grading tray or a sheet of white paper. The most common defects consist of particles of seed, dark or off-colored particles, and grit, sand or silt. The number, size, color, and type of such defects should be taken into consideration in scoring their effect on the appearance and eating quality of the product.

If the appearance and eating quality of the product is not materially affected by the presence of defects, it should be scored as **practically free from defects**. In this connection a few rather large dark or off-colored particles might affect the appearance more than several times that number of small, lighter colored particles.

Canned pumpkin or squash in which the defects are decidedly noticeable but not to the extent that they seriously affect the appearance or eating quality should be scored as meeting the requirement of **fairly free from defects**.

The degree of freedom from sand, grit, or silt should be determined by chewing several spoonfuls of the product and noting the presence or absence as it affects the eating quality.

Canned pumpkin or squash shall be considered as containing no grit, if, upon chewing representative portion of the product, no grit or sand is detected. In other words, grit should not be detected in the product when subjected to normal eating or chewing tests.

Canned pumpkin or squash shall be considered as containing a trace of grit, if, upon chewing a representative portion of the product, grit or sand is detectable in occasional mouthfuls but not to the extent of materially impairing the eating quality. If grit or sand is present in amounts so as to be frequently detected upon chewing, the eating quality is materially affected and the product should be considered as containing more than a trace of grit.

The supervisor should be consulted when in doubt with respect to the classification for defects.

I. Proper Evaluation of the Grades.

After the inspector has properly applied the detailed requirements of the grade standards, it is necessary before certifying the grade of the product to assure themselves that the overall appearance and eating quality of the product reflects the grade that the standards have intended. If the inspector feels the grade standards do not properly reflect the proper quality level they should consult their supervisor.

V. CERTIFICATION

A. General Instructions.

General instructions pertaining to certification of all processed food products are applicable to this product.

B. Special Instructions.

1. Name of the Product Inspected.

The inspector should use the name of the product on the label or if not labeled the name declared by the applicant. It will be the policy of the Inspection Service to certify the name of the product without question as either squash or pumpkin on the basis of applicant's declaration.

2. Requests for Specific Certificate Information.

Certain purchasers of this product have set up specific requirements in their purchase specifications, sometimes based on the United States standards. For example, such purchase specifications might require a Grade A product and also a minimum score of 27 points for consistency.

Procedure. If specifically requested, show such special information in the body of the certificate as:

Consistency score - 27 to 29 points.

The grade statement may also show compliance (or noncompliance) with a specific purchase specification in the manner outlined in general instructions on the subject of certification.

VI. INSPECTION DURING PACKING OPERATIONS

A. Sanitation.

It is the duty of the inspector assigned to a plant to see that good standards of sanitation are maintained. There is a very rapid build-up of scum and starch on belts, flumes, and other parts of the machinery, causing not only offensive odors in the plant but my cause off-odor, off-flavor, and spoilage in the product. These conditions can be controlled by careful periodic cleaning of all pieces of equipment.

B. Operations.

Following are particular points to observe during the processing operation. They supplement general instructions or emphasize particular points to observe:

1. Raw Material.

a. Observe the condition of the pumpkin or squash at the time they arrive at the plant.

b. The length of time the raw product is held before processing should be noted.

c. Prevalence of defective pumpkin or squash -

(1) Presence of excessive dirt, sand, or silt.

(2) Presence of damaged or bruised pumpkin or squash.

(3) Presence of rot, mold, and other decay.

d. Presence of green and overmature pumpkin or squash.

The colors seen in the fresh flesh of pumpkin and squash are due

to two groups of pigment substances; the carotenoids, which are yellow or orange-yellow and the chlorophylls, which are green. The different varieties show very great differences in the amounts of the two groups of pigments. Generally there is a deepening and intensification of the yellow or orange-yellow color as a result of the steaming of the product while the green color may change to a greenish-brown or reddish-brown color due to the decomposition of the chlorophyll. Upon cooking there is an apparent brightening of the colors in pumpkin or squash.

Pumpkins or squashes should be allowed to ripen in the field. If picked too green the under portions of the skin will have a greenish color and this may be carried over into the finished product. Certain green varieties, for instance the green Hubbard, are not suitable for canning purposes because of the excessive amount of this greenish tissue that persists even to the full matured squash.

e. Presence of infestation, such as flies, gnats, or other insects.

2. Preparation and Workmanship.

a. Check effectiveness of removing defective, green pumpkin or squash, and stems.

b. Check effectiveness of washing process in removing dirt, silt, and loose extraneous material.

c. Check cleanliness of wilter screen periodically, thereby assuring good drainage.

d. Check consistency of the pumpkin at periodic intervals.

There are several factors which affect the consistency of canned pumpkin or canned squash. Some of these are the variety or varieties used, the maturity, time between delivery of the raw product at the plant and wilting and pressing and the extent of wilting and pressing. Starch appears to be most abundant just before the **full ripe** stage, and it appears desirable to use the pumpkin or squash at this stage for best consistency. The starch content of pumpkin or squash reduces sharply after the pumpkin or squash is taken from the vine, and every day in the cannery yards is therefore detrimental to the final consistency as well as to other quality factors. Since it is not always feasible to control the delivery, ripeness, and storage of the raw material, processors may increase the degree of pressing to the desired results. Some wilting systems introduce an undue large quantity of condensed steam into the pumpkin or squash, thereby reducing the consistency by thinning. Experienced processors are able to regulate the consistency very closely.

e. Check efficiency of finishers periodically.

The finish of canned pumpkin and canned squash is affected by the varieties, maturities of the pumpkin or squash, the time and temperature of the cooking process. It is also affected by the size of the openings in the finishing screen. The finish is called **pasty** when the granular structure has been destroyed. A **pasty** finish may result from too immature or too ripe pumpkin or squash, overcooking, or the use of screens in the finisher that are too fine. Screens with perforations of 0.040 openings are generally used in the finisher and will result in a fine **grain**. Waste from the finisher should not be of a stiff or dry consistency. If this condition exists inspectors should watch for defects caused by pressing too much material through screens.

f. Check presence of defects, such as sand, grit, or silt, pieces of seed, fiber, and from dark or off-colored particles.

The freedom from defects depends largely on the quality of the pumpkin or squash used, the efficiency of the washing and trimming operations, and the care exercised on the final inspection belt.

g. At frequent intervals, check fill and closing temperature of cans.

3. Processing.

The time and temperature of processing has a direct effect on the quality of the finished product and the procedure should be observed regularly. In this connection, however, make no recommendation unless it is obvious that the standards established by the management for these factors are not being maintained.

4. Starch Pockets.

In filling extra dry pumpkin or squash into cans, air pockets are frequently left. On processing, these air pockets fill with liquid from the pumpkin or squash which carries with it starch in solution. On cooling the cans after processing this starch solution solidifies and forms a white mass which fills these pockets. Some have thought that this white material was added starch. It is a starch material but came from the high starch content of the pumpkin or squash itself. It is, therefore, entirely normal to a heavy bodied pumpkin.

Because pumpkin and squash normally have substantive amounts of natural starch, there is no necessity for added starch in a product that is properly processed under good commercial practice. Therefore added starch or added starch and water are considered adulterants under the general provision of the Federal Food, Drug and Cosmetic Act.

C. Recommendations.

When any abnormal or unsatisfactory condition is observed in either the sanitation, operation, or processing, it should be brought to attention of the management though a proper, previously designated, official. Written reports of unsatisfactory conditions should be made to the plant management whenever it appears necessary. Suggestions and carefully thought-out recommendations should be made for overcoming objectionable conditions and improving plant operations. The inspector should keep the supervisor informed and whenever serious problems arise, they should consult their supervisor for advice. The inspector must be alert, tactful, and diplomatic at all times. They must also keep in mind that they are assigned to render a helpful service and have no regulatory authority.