United States Department of Agriculture

Agricultural Marketing Service

Fruit and Vegetable Division

Shipping Point and Market Inspection Instructions for Tomato Plants

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These instructions have been developed by the Fresh Products Branch to assist officially licensed inspectors in the interpretation and application of the U.S. Standards for Grades of Tomato Plants, 7 CFR Section 51.4505.

These instructions do not establish any substantial rule not legally authorized by the official grade standards. This publication supersedes any previously issued inspection instructions.

Refer to the General Inspection Instructions for additional information pertaining to date, inspection point, carrier, condition of carrier, lading, etc. not covered in these instructions. (Reference to "General Inspection Instructions" in all Fresh Products Branch publications refers to any one or all of the following - General Shipping Point Inspection Instructions, General Market Inspection Instructions, or Fresh Fruit and Vegetable Certificate Writing Handbooks.)

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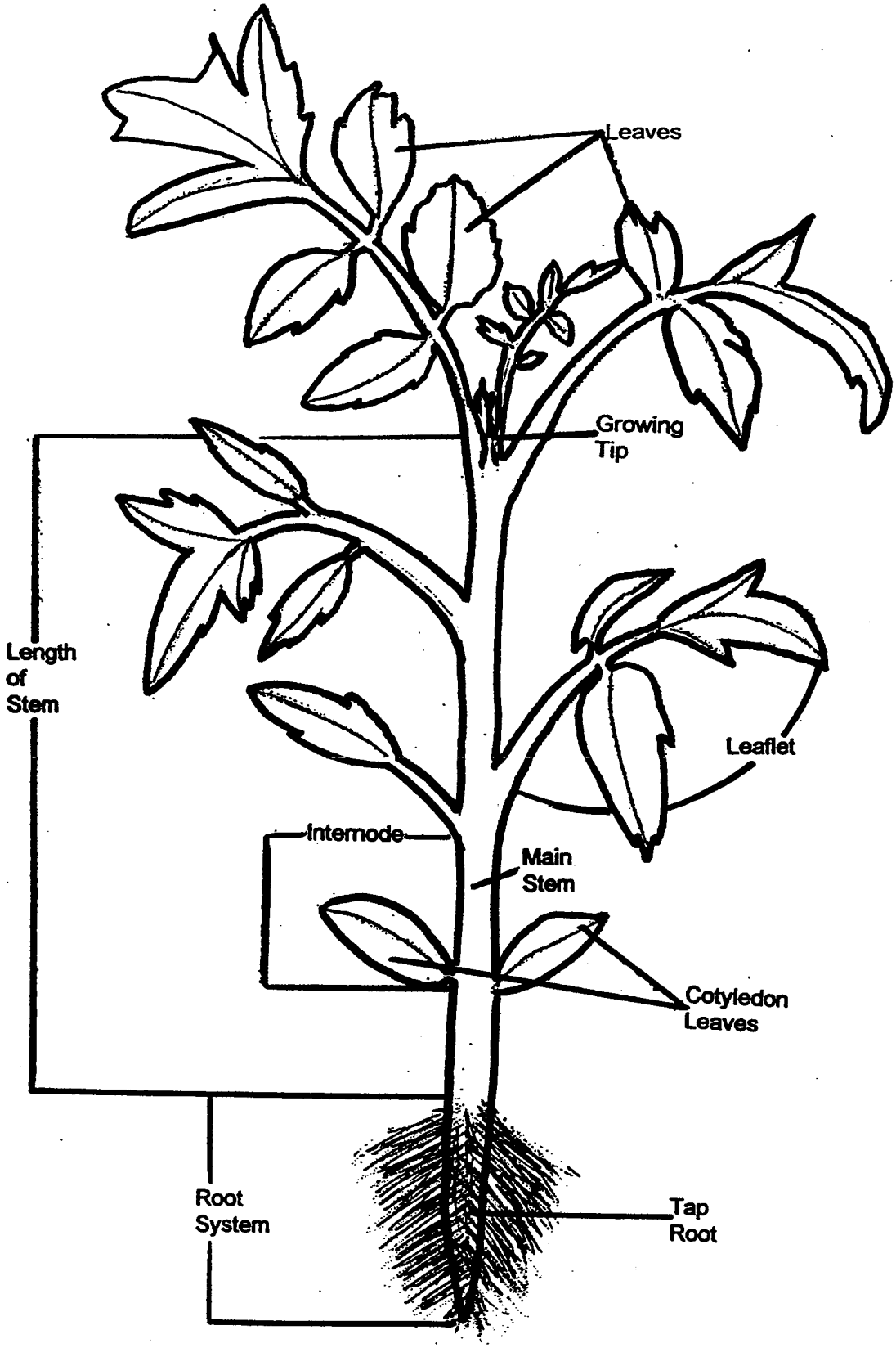

Illustration I - Tomato Plant

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Appendix I - U.S. Standards for Grades of Tomato Plants

(1) Sampling

Representative sampling is just as important as correct grade interpretation. Accurate certification is only possible if the samples examined are truly representative of the entire lot or the accessible portion of the load or lot. A manifest or accurate count of the lot is essential in determining the number of samples to take for the lot size. If plants are packed loose, as a guide, inspect a **minimum** of 50 plants per sample. If plants are bunched, inspect a **minimum** of 50 plants per bunch as the sample. Two samples (bunches) may be selected from the same container.

The sample size for determining standard bunching shall be the **entire bunch.**

The sample size for determining size shall be a **minimum** of 50 plants, whether the plants are loose or bunched.

Due to potential variations in size, and/or quality, no definite rule can be provided as to a required number of samples. It is the inspector's responsibility to examine enough samples to ensure an accurate picture of the entire lot. However, as a guide, on a full load of tomato plants, **at least** 10 samples should be examined. If a load contains different lots (sizes, brands, PLI marks, types, etc.), more samples may need to be examined to give an accurate picture of each lot.

(2) Tolerances

§51.4506... In order to allow for variations incident to proper grading and handling in the foregoing grade, the following tolerances, **by count**, are provided as specified:

Total Defects		Size	
A. Fails to meet requirements of U.S. No. 1 grade	10%	**A.** For plants in any lot failing to meet the specified size requirements	10%
B. Decay, Early Blight, or Bacterial Canker	0%	**B.** Included in "A", for plants smaller than the specified minimum diameter	5%

(3) Application of Tolerances

There is no application of tolerances placing restrictions on a container basis in the U.S. Standards for Grades of Tomato Plants. All factors for which tolerances are provided in the standards shall be considered within tolerance as long as the lot averages within grade.

(4) Products Inspected

The following information shall be given:

- Commodity
- Type of Container
- Distinguishing Marks
- Quantity Inspected
- State or Country of Origin

Commodity

The standards require that the lot be of similar varietal characteristics. This means that the plants have the same general character of growth and color.

It is only necessary to state "Tomato Plants" on the certificate. The inspector shall not attempt to certify variety. However, it is customary for growers to mark each container with the variety name and this shall be shown on the notesheet and certificate in accordance with the facts. If the plants are bunched, report as "Bunched Tomato Plants." For bunched plants, there is a separate section in the standard pertaining to "Standards for Bunching." (See the section on Standards for Bunching for further explanation.)

Type of Container

Tomato plants are generally packed in either 5/8 bushel hampers, pyramid crates, or round bottom or tub type bushel baskets. Report on the certificate whatever type of container(s) is being used.

Distinguishing Marks

Significant identifying brands, grower or shipper names and addresses, count, certification, and grade are commonly found on containers. It is customary

for growers of certified plants to place a certification label on each container. This fact should be reported on the certificate.

Whenever a container is labeled, printed, tagged, or otherwise marked with a brand, grade, or Positive Lot Identification mark, it shall be reported in the "Markings" or similar section. This also includes shipper's name and address, lot numbers, varieties, sizes or weight. Quote this information just as it appears on the containers. If the containers bear no brand, grade or any other marking, it shall be stated as "No Brand."

Federal and Federal-State lot numbers (PLI) shall always be reported on the certificate.

Quantity Inspected

The quantity inspected is the number of containers available for inspection at the time of the inspection, not necessarily the amount on the manifest, or quoted by the applicant. Show the actual number and the unit of container (hampers, crates, baskets).

If the quantity inspected is a small lot (less than 100 containers), or is a larger lot that can be counted with accuracy, this should be reported on the inspector's authority as "inspector's count." If the number of containers is not counted by the inspector, then "applicant states" shall be indicated on the certificate.

State or Country of Origin

The inspector should not make a positive statement on his/her own authority, but when container markings list the State or Country of origin, it should be quoted. This policy is necessary because some firms may use one mark on the same product that they may pack in two or three states and the inspector can certify only to the marks and has no means of knowing in what state or country the plants are grown. (If packages are not marked or the plants are in bulk, refer to the General Inspection Instructions.)

(5) Temperature of Product

Due to the importance of temperature, it is essential that the inspector accurately read and report the temperature or range in temperature on each lot. Since it is impractical to take pulp temperatures of tomato plants, the temperatures within bundles or among individual, loose plants should be reported. Report

temperatures regardless of the location of the product, whether in the carrier, warehouse, or stacked on the platform.

(6) Condition of Load and Containers

Describe in detail on the notesheet any unusual or defective condition of the load, or containers, if such a condition affects the quality or condition of the tomato plants, (such as a shift in the load, crushed or broken containers, etc.)

Refer to the General Inspection Instructions for general information concerning condition of load and containers.

(7) Condition of Pack

The standard has a separate section on "Standards for Packing." It pertains only to tomato plants that are bunched. It includes a ten percent (10%) tolerance for containers which do not meet the requirements of Standards for Packing. The Standards for Packing is **not** optional. However, since it is separate from the grade section, a lot could meet the requirements of the grade and fail the requirements of Standards for Packing (and vice versa).

> **§51.4508 Standards for Packing...**Tomato plants in individual bunches must be arranged with the tops of the roots in approximately the same plane. The roots shall be protected by an adequate supply of moistened peat moss, sphagnum moss, sawdust, or other suitable packing material with moisture holding capacity, well scattered over the roots in the bunch and held in place with a paper wrap. The bunches also must be packed upright and fairly tightly in containers of sufficient height to accommodate the size of the plants packed and in such a manner as to not cause bending or excessive bruising of the plants. A 10% tolerance is provided for containers having bunches that fail to meet these requirements.

With varying practices in preparing bunches for shipment, it is difficult to explain just what is an adequate supply of packing material and when it should be considered well scattered over the roots. Plants often arrive at receiving points in good condition when not all of the roots are in contact with packing material. As a guide, one handful of packing material per bunch of 100 plants shall be considered an adequate supply. However, this amount should not be considered as well scattered over the roots, unless it is spread over a considerable portion of the paper wrap before placing the plants on the paper wrap, prior to rolling up the bunch; or

placing the plants on the wrapper then scattering the packing material over the roots of the plants before rolling up the bunch. If the packing material is in a pile (without being spread out), the roots of the bunches shall not be considered adequately protected and they shall be certified as failing to meet packing requirements.

Sometimes bunches are packed too tightly in containers. This may cause bruising of the plants and under certain conditions may cause heat injury during transit. The "Standards for Packing" requires that bunches shall be packed upright **fairly tightly** in containers. Therefore, any pack which is "tight," or "slightly slack" would not meet the requirements of "Standards for Packing." Additionally, containers must be of sufficient height for the size of the plants to be accommodated, so that bending of the plants or excessive bruising is prevented.

The following terms should be used with the meanings indicated for describing tightness of pack:

"Tight" means that the pack is so tight that it is impossible to force the palm of the hand between the plants and the side of the container without crushing or bruising the plants, or the plants are so long as to make it impossible to lid the container without considerable bending and folding of the tops.

"Fairly tight" means that the container is sufficiently filled to prevent appreciable movement of the bunches within the container, but not so tight as to prevent forcing the palm of the hand between the plants and side of the container without crushing or bruising the plants.

"Slightly slack" means that the container is not sufficiently filled to prevent excessive movement of the bunches which may result in damage to the plants.

The above terms (or combination of terms) shall be used to describe either plants packed loose or packed in bunches. However, compliance or non-compliance with the "Standards for Bunching" must be determined for bunched plants. (See the section on "Standards for Bunching" for further information.)

(8) Size

The following information shall be given:

- Count per bunch (when plants are bunched)
- Diameter of stems
- Length of stems
- Off-size

Size is a part of the grade requirements, therefore if the off-size tolerances are exceeded the lot would "fail to grade U.S. No. 1 account off-size." When determining size, ***except for count per bunch,*** **a minimum** of 50 plants shall be the sample. When determining count per bunch, the entire bunch shall be the sample. The inspector shall keep columns for count per bunch and size determination on the notesheet as follows:

Count per bunch	Stems under minimum diameter	Stems under minimum length	Stems over maximum length	Total off-size

In reporting "Size," the inspector should give as clear a picture as possible of the size of the tomato plants in each lot. If the plants are bunched the first statement should show the range and average count per bunch. This should be followed by a statement of the range in diameter of the stems. Next should be a statement of the range in length of the stems including a "mostly" range if necessary. Finally, the percentage of off-size plants shall be shown **unless** the size factors are "within tolerance" and the lot as a whole meets the requirements of the grade.

Prior to sizing tomato plants, inspectors should ascertain from the applicant whether the specifications for diameter and length of stem vary from those specified in the grade standards and if so, make the size determinations on that basis. A total tolerance of ten percent (10%) is provided for plants that fail to meet size requirements including five percent (5%) for plants that fail to meet the **minimum** diameter requirement.

Plants with stems under the minimum diameter may also have stems under the minimum length. In order to simplify scoring of plants for size, **no plant shall be scored more than once for any size requirement.** Since minimum diameter of stem is considered more important than length of stem, plants shall first be measured for diameter.

Minimum diameter of stems is determined by measuring with calipers or a ruler the greatest thickness of the stem either at the first or second internode above

the cotyledons. (See the illustration of tomato plant in the front of the handbook which shows the area of an internode.) It may not be necessary to measure the diameter of all plants as after measuring a few, the inspector will be able to judge size fairly accurately. Only those close to the minimum will need to be measured. The inspector shall keep an accurate record of the number of plants in each bunch that are smaller than the specified minimum diameter.

Length of stems is determined by measuring plants from the top of the underground root system to the growing tip of the plant. The growing tip is the terminal bud and should not be confused with tips of some of the leaves emanating from lower down on the stem. Unless otherwise specified, the length of the stems shall be not less than 6 inches nor more than 9 inches. The range in length of stems should be reported and, if applicable, a smaller range in length of most of the stems shall be shown. For example, "Length of stems ranges from 6 to 10 inches, mostly 7 to 9 inches."

The inspector should also keep a record of plants having stems below the specified minimum length if they have not been previously scored as undersize for the minimum diameter requirement. Likewise, record the number of plants that have stems that exceed the maximum specified length, if such plants have not already been scored for undersize diameter or length.

When the inspection is completed, the number and percentage of off-size plants must be determined for the lot as a whole. There is a restricted tolerance of five percent (5%) for those plants which fail to meet the specified minimum **diameter**. The total off-size tolerance of ten percent (10%) includes the five percent (5%) restricted tolerance.

(9) Standards for Bunching

"Standards for Bunching" is a separate, optional section of the standards. An applicant may request an inspection based on this option. It only pertains to plants that are bunched. A lot could meet the requirements of the grade (including size requirements) and fail to meet the requirements of the Standards for Bunching (and vice versa).

> **§51.4507...Standards for Bunching:** when bunched, the number of plants per bunch shall average not less than 50 plants in 50-size bunches and not less than 100 plants in 100-size bunches. If bunches do not meet this requirement, they would "fail to meet the requirement for Standards for Bunching."

Since there are specific requirements for the average number of plants per bunch in the Standards for Bunching, the inspectors should make an accurate count

and keep a record on their notesheet of the number of plants in each bunch examined. Upon completion of the inspection, the counts should be totaled and averaged. There are no restrictions as to counts in individual bunches, but in order to meet requirements of Standards for Bunching, the lot must average **not less than** 100 plants per bunch for 100-size bunches and **not less than** 50 plants per bunch for 50-size bunches. The range and average count shall be reported under "Size" on the FV-184 Shipping Point certificate, and reported under "Other" on the FV-300 Market certificate.

(10) Quality and Condition

Statements pertaining to freshness, leafiness, color, amount and kind of quality defects, and amount of decay are shown under the appropriate heading. Those factors noted with one asterisk (*) shall be reported as Condition factors on market certificates. Those factors noted with two asterisks (**) may be considered as Quality or Condition depending on the circumstances.

Freshness (*)

Tomato plants can be described as "fresh," "fairly fresh," or "excessively wilted, limp and flabby." "Fairly fresh" is the minimum requirement for the U.S. No. 1 grade. Plants that show any evidence of wilting cannot be described as "Fresh." The overall appearance of the plant is taken into considered when determining freshness. This includes the leaves, leaflets, stem, and roots.

> **§51.4511...**Fairly fresh means that the stems, roots, and foliage are not excessively wilted, limp, and flabby.

From the time they are pulled until they are packed, the plants are usually more or less wilted owing to several hours exposure to air and sun. However, after they are packed and the roots are properly covered with moistened peat moss or other packing material, they will ordinarily freshen up after a few hours unless they have been subjected to an unusual amount of exposure to the sun. Plants should not be scored unless they are **excessively** wilted, limp, and flabby and the inspector is fairly confident that they have been exposed to the point that would prohibit recovery and growth.

If a lot appears to be too badly wilted to meet the grade requirements, it shall be described and reported as "excessively wilted, limp, and flabby." Occasionally it may be necessary to score all plants in a given container under such circumstances. If such conditions are found, every effort shall be made to ascertain the approximate number of packages so affected and, if possible, give the location in the car or trailer.

Underdeveloped Leaves

Ordinarily, plants grown under normal conditions and pulled at the proper time will be leafy, which means that the leaves of the plant are of normal development and not small and underdeveloped. If individual plants show abnormally small and underdeveloped leaves, they shall be scored as "underdeveloped leaves."

Color (*)

Plants grown under normal conditions and which are free from disease should be normal color, which means that the plant shows a healthy green color. Plants which have leaves that are turning yellow or are otherwise poorly colored from any cause shall be scored as "poorly colored." "Normal color" is the minimum requirement for the grade.

Plants that have exhausted the available food supply in the soil and that have been allowed to remain in the field will often show a purplish cast. It will normally be found that such plants are more or less stunted in growth and the stems are hard and woody. Such plants shall be scored for woodiness rather than color. Inspectors should consult their supervisors before scoring plants exhibiting a purple bloom as "poorly colored."

Defects

The principle defects which affect tomato plants are: weak plants, broken plants, plants with short tap roots, curved or crooked plants, soft plants, woody plants, plants with heating injury, foreign material, insect damage and diseased plants.

Weak Plants

Plants are required to be strong.

§51.4512... Strong means that the stem is fairly stiff and sturdy enough to hold the top in a reasonable erect position.

Plants shall be scored as "weak plants" only when some abnormal growing condition causes the **stems** to be weak. Weak plants should not be confused with excessively wilted plants which shall be scored as excessively wilted, limp and flabby.

Broken Plants

Broken stems or tap roots are one of the most prevalent of all types of defects of tomato plants. In handling from the field to packing shed, it is to be expected that some plants will be broken. Score as a "broken plant" when the stem is broken or when the main tap root is broken.

Short Tap Roots

The grade requires that the length of the main tap root shall be not less than 1¾ inches. Any plant with a shorter tap root shall be scored as a defect, "short tap roots." If requested, the inspector can give a range in length of the tap root. (See the illustration of a tomato plant in the front of the handbook which shows where to measure the tap root.)

Curved or Crooked Plants

The grade requires the stem to be "fairly straight."

§51.4514... Fairly straight means that the stem is not more than moderately curved or crooked.

As a guide, moderately curved or crooked shall mean curved or crooked up to an angle 45° from upright. Some plants have a tendency to be very angular, whereas others will be materially curved. Natural elements, such as windstorms, may flatten a field of plants. As they recover and continue to grow, they will have a distinct right angled curve near the point of root attachment. When badly curved or crooked plants are tied in bunches in the field or when bunched in the packing sheds, many are apt to be broken. If plants are broken, score as "broken plants." Plants with stems which are more than moderately curved or crooked shall be scored as curved or crooked plants.

Soft Plants

The U.S. No. 1 grade specifies that plants shall not be soft.

§51.4516... Soft means that the stem, approximately midway between the growing tip and the base, yields more than slightly to moderate pressure of the fingers.

Following prolonged rainy periods, tomato plants may grow so rapidly and take up so much water that the stems become very soft. Additionally, growers occasionally stimulate plant growth by use of considerable quantities of nitrates and

as a result, soft plants are produced. After soft plants are pulled, they will wilt very rapidly and are seriously weakened. There is usually a heavy loss when such plants are set in the field, particularly if they are transplanted during warm, sunny weather. Score and report this defect as "soft plants."

Woody Plants

The U.S. No. 1 grade specifies that plants shall not be woody.

§51.4517... Woody means that the stem is excessively hard and fibrous.

Under prolonged periods of drought, tomato plants may become excessively stunted and the stems hard and woody. In order to determine whether plants are woody, the inspector will have to break the stems of a few plants. If after breaking, the stem is excessively hard and fibrous, regardless of the cause, it shall be scored as "woody plants". The inspector should not break an excessive number of plants searching for woody plants. However, if woody plants are found in a lot, the inspector shall break enough stems to give an accurate picture of the lot.

Heating Injury (*)

Injury from heating will not usually be encountered at shipping point because plants are generally shipped out the same day that they are pulled. However, plants that are stacked too tightly, not allowing air to freely circulate about the plants; plants that are packed too tightly, are not well ventilated during transit; or plants that are packed when the leaves are wet, have a tendency to heat and will most likely show damage when unloaded.

Minor injury first causes the leaves to turn yellow. Under extreme conditions, the stems and leaves will turn black, killing the plant. Decay of plant tissue is likely following extreme heating injury. Any plants showing heating injury that materially affects normal growth shall be scored and the condition shall be reported so as to give a clear picture of the extent of the injury.

If the heating injury has advanced to decay, score the plant as "decay." If the plants appear excessively wilted, limp, and flabby, score them as "excessively wilted, limp, and flabby." If the leaves do not show a healthy normal color, score as "poorly colored." However, if the plants are discolored (stems and/or leaves gray to black) and do not show normal growth describe the defect as "heating injury."

Temperatures are particularly important when describing a lot or load affected by heating injury. Additionally, it is important to describe the location of affected plants in the containers and in the load (similar to a freezing statement).

Foreign Material

The U.S. No. 1 grade requires that plants be free from damage by foreign material. The presence of weeds in bunches of plants shall be classed as foreign material. Bunches containing an unreasonable number of weeds shall not be certified as meeting grade requirements. Most fields are more or less weedy and if pullers persist in pulling a number of plants at one time, they invariably include some weeds. Weeds are objectionable in bunches of plants because in mechanical planting, the operator does not have time to sort out weed plants from tomato plants. Weed plants which are approximately the same size as the tomato plants are considered more objectionable than small weed plants.

Size of the weed plant is the determining factor when considering how objectionable the weeds affect the appearance of the lot. As a guide, 100-size bunches should not be certified as meeting requirements if the bunches have an average of more than 5 weed plants approximately the same size as the tomato plants. 50-size bunches should not be certified as meeting requirements if the bunches average more than 3 such weed plants per bunch. Small weeds an inch or two in height are not particularly objectionable from the transplanting viewpoint and should not be considered a factor in scoring foreign material.

Unless the number of weeds present is sufficient to refuse grade certification, no mention of this factor shall be made on the certificate. However, if there are enough bunches showing excessive numbers of weed plants to affect the grade, then the approximate range and average of such plants per bunch shall be reported. For example: "In approximately one-half of samples, from 6 to 15, average 8 large weed plants per bunch. Remainder averages less than 3 weed plants per bunch." The corresponding grade statement for this example would read: "Fails to grade U.S. No. 1 account excessive weed plants." Percentage of U.S. No. 1 Quality can not be reported if foreign material is a factor in the lot failing to grade.

Insect Injury (**)

Occasionally tomato plants may be found which have been partially defoliated by insects. If such plants have been defoliated to the extent that the normal growth of the plant or its appearance is materially affected, they shall be scored. Live insects should be reported as Condition. Dead insects shall be reported as a Quality factor. When both dead and live insects are present, report as a factor of Condition.

Decay, Early Blight, and Bacterial Canker (*)

No tolerance is permitted for decay, Early Blight and Bacterial Canker in the U.S. No. 1 grade. (See description of Early Blight and Bacterial Canker in the next section.)

Ordinarily, no decay will be found at shipping point because plants are pulled and shipped the same day. Under these circumstances, the expression "no decay" shall be used on the certificate. Some decayed plants may be found in lots that were held over for a period of time before being shipped, particularly if the plants were allowed to heat. If minute quantities of decay are found affecting plants scattered throughout the load, it may be reported as "less than 1/2 of 1 percent decay" or "less than 1 percent decay," etc., in accordance with the facts. Inspectors shall not use the expressions "practically no decay" or "no decay apparent." Follow the respective guidelines for reporting decay at shipping point or at destination.

(11) Diseases of Tomato Plants

All tomato plants affected with disease shall be scored as **Quality defects EXCEPT** when there is a breakdown of plant tissue, in which case the plants shall be scored as decay. The inspector should remember that **no** lots having plants affected with Bacterial Canker or Early Blight may be certified as meeting grade requirements. Plants affected with all other **diseases, *when not decayed***, shall be scored as Quality defects against the ten percent (10%) total tolerance.

Bacterial Canker (Phytomonas michiganensis)

Bacterial Canker is a destructive disease of tomatoes caused by a bacterium that may be carried by the seed. The disease occasionally is found in the greenhouse as well as in the field, and attacks plants at any stage of growth. Seedlings frequently are infected and may rapidly be destroyed or produce plants that remain stunted and valueless. Other times, however, they may show no evidence of the disease until sometime after transplanting in the field. On older plants the first symptoms consist of wilting of the leaf margins on the lower leaflets. This wilting usually appears first on the leaflets on only one side of the leaf and as the margins dry, the leaflets curve upward. Later these leaves become brown, wither and die, but the petiole remains attached to the stem. The plant itself often shows a one-sided development of the disease which causes it to lie over in characteristic fashion. On larger plants, a single shoot may be killed early, with the remainder of the plant appearing normal for some time. Eventually though, the entire plant is affected. As the disease progresses, much of the foliage is

destroyed. The bacteria attack the inner and outer phloem of the stem end. When this occurs, the pith is easily separated from the woody portion of the stem. As the disease progresses, the pith becomes yellow and mealy in appearance and cavities form within the stem. Later the destruction of the tissues extends to the outer surface of the stem and the open cankers are formed which give the disease its name. Diseased plants may die early, but often survive until harvest.

When a positive diagnosis can be made of plants infected with Bacterial Canker, such plants shall be scored as Quality defects. If plant tissue breakdown is apparent, score as decay and report as Condition. Since no tolerance is permitted for plants affected with this disease, lots having such affected plants **may not** be certified as meeting grade requirements.

Early Blight (Alternaria solani or Macrosporium solani)

This disease occurs to some extent in most tomato growing regions and is one of the most common and serious diseases of tomatoes grown in the Eastern, Southern, and Central States. The fungus causes a stem canker or "collar rot" that is very damaging to young seedlings and transplants in the field. It produces a spotting of the leaves that may partially defoliate the plants and greatly reduce the size and quality of the crop. Seedling infection probably is most often due to the presence of the fungus in the soil, and occurs most abundantly during periods of rain or extremely humid weather when the air temperatures are above 80° F. Crowding of plants in the seed bed favors the rapid spread of the disease and poorly nourished plants seem most susceptible. In the field, the spores produced in the spots on the leaves and stems are spread by wind, rain, or human channels to adjacent plants and, when climatic conditions favor infection, the disease soon spreads throughout the field.

The first symptoms of Early Blight usually appear on the older leaves and consist of small, irregular, dark spots that enlarge until they are one-fourth to one-half inch in diameter. As they enlarge, they commonly show ridged, concentric rings in a target pattern.

On the stem, Early Blight causes small, dark, slightly sunken areas that enlarge to form circular or elongated spots that occasionally show concentric markings like those on the leaves. On seedlings, large spots often appear on the stem at the ground line causing the partial girdling known as "collar rot." When set in the field, such plants die, or the stem is so weakened that it breaks over early in the season, and the plant is forced to depend on a reduced root system developed where the portion of the stem above the canker is in contact with the soil. Such plants remain small and produce little fruit.

All plants showing either the leaf spot or the later stem canker stage of the disease shall be scored. It will be noted that no tolerance is permitted for plants

infected with Early Blight and lots of plants having the disease **may not** be certified as meeting grade requirements.

Bacterial Wilt (Phytomonas solanacearum)

Bacterial Wilt is most common on tomatoes grown in the South, but occasionally is also found in other tomato growing regions. The bacterium causing the disease lives in the soil and infects the plant through the root or stem. It is not common in low, moist soils and is most active at temperatures above 75° F. The symptoms consist of a rather rapid wilting of the entire plant that is not accompanied by any yellowing or spotting of the leaves. If the stems of wilted plants are cut across, near the ground line, the pith shows a darkened, watersoaked appearance and a grayish, slimy exudate is noted when the stem is pressed. In later stages of the disease, there is also a brown decay of the pith and cavities may be formed in the stem. These symptoms differ from those of Fusarium and Verticillium Wilt which do not cause a sudden wilting or decay of the stems in early plants. Seedling plants often do not show symptoms of the disease until after transplanting in the field.

It is expected that inspectors will seldom encounter plants infected with this disease, but if positive identification can be made, such infected plants shall be considered as defective and scored against the total tolerance. In the later stages, when brown decay has developed, infected plants shall be scored as decay and reported as a condition defect (keep in mind that there is a zero tolerance for decay).

Southern Blight (Sclerotium rolfsii)

The disease known as Southern Blight is caused by a fungus that occurs to some extent throughout the southern United States and in some areas of the Pacific coast. It makes little growth at temperatures below 70° F. It requires abundant moisture for growth and is most prevalent in light, poorly drained soils. Apparently it produces no spores, but threads of the fungus spread through the soil and the infected areas widen from year to year. It is also distributed by means of sclerotia which live for some time in the soil and are spread by rain or cultivation. The first symptoms of the disease consist of a general drooping of the leaves suggestive of Bacterial or Fusarium Wilt. This wilted condition becomes more marked from day to day and the plant eventually dies. The stems of these plants show a brown decay of the tissue at the soil line, and frequently are covered with a white fungus mat in which are imbedded numerous small, light brown bodies approximately the size of a mustard seed. These sclerotia are a distinguishing feature of this disease.

Infected plants, upon positive identification, shall be scored as a Quality defect. In the later stages when there is evidence of tissue breakdown, infected

plants shall be scored as decay (keep in mind that there is a zero tolerance for decay).

Bacterial Spot (Phytomonas vesidatorium)

Bacterial Spot is most noticeable in its effect on the fruit, but also may cause considerable injury to the foliage of seedlings and plants in the field. On the leaves, the first symptoms consist of irregular, small, dark spots of a greasy appearance, whose centers dry out and frequently tear apart. Seedlings are often severely damaged by this leaf infection and it frequently causes some defoliation in older plants. There is also some spotting of the stems, particularly in seedling plants, and the infection of the flower parts at times causes a considerable amount of blossom drop. The bacteria occur in great numbers in the spots on the leaves and fruit. The most severe infections occur during heavy rains that splash the organism from plant to plant.

Plants visibly infected with this disease shall be scored as quality defects against the total tolerance.

Root Knot

Tomatoes, like many other crops, are subject to the attack of minute eelworm or nematode (Heterodera marioni) which produces characteristic swellings or galls on the roots. Greenhouse tomatoes often are badly damaged by this nematode and it causes considerable injury in the fields in the warmer regions of the United States. The galls vary in size from one-sixteenth of an inch to one inch in diameter, depending on the size of the root and the number of nematodes within them. These galls interfere with the ability of the plant to obtain water and nutrients from the soil. Infected plants are dwarfed and sickly, wilt readily in dry weather, and may lose their leaves prematurely. Frequently, the plant is killed and whenever the roots are severely infested, the yield is greatly reduced.

The galls contain female root-knot nematodes, which have pear-shaped white bodies about one-thirtieth of an inch in diameter. A single root may contain several hundred and each female is capable of producing more than 1,000 eggs in two to three months. The eggs hatch in a short time and slender larvae emerge and make their way through the soil to enter other roots, where they grow to maturity and produce eggs. The length of time for a producing female, from egg to egg, is approximately 25 days in soil temperatures around 80° F. There is no activity or reproduction when the soil temperature is less than 53° F. If no roots are available, the larvae may live in the soil for at least two years.

Plants showing the presence of galls on the roots shall be considered as defective and scored against the total tolerance.

(12) Grade

Under this heading a statement shall be made showing whether or not the lot meets the requirements of the grade. When the load inspected consists of different lots that can be differentiated by marks or location, and some meet grade requirements while others fail, separate statements shall be made for the different lots. In all such cases extreme care should be exercised to indicate the grade on each lot and to avoid grade statements that are indefinite or that tend to contradict the facts reported under the previous headings of the certificate. The inspector should remember that the grade statement is an interpretation of the facts previously stated.

Whenever a lot is reported as failing to meet grade requirements, the reasons for its failure to grade shall be shown.

If size specifications are different from those specified in the grade, such size specifications shall be stated in connection with the grade statement if the lot meets such specifications. Otherwise, a statement of failure to meet such specifications shall be shown.

Also, if lots fail to meet bunching or packing requirements, these facts and the reasons thereof shall be shown in connection with the grade statement.

Certification of Percentage of U.S. No. 1 Quality

In lieu of reporting failure of lots to grade and the reasons for the lot failing to grade, it is permissible to state the approximate percentage of plants that are of U.S. No. 1 quality. The percentage of U.S. No. 1 quality in a lot refers to the percentage of those plants that will meet the requirements of the U.S. No. 1 grade without considering any tolerances. In calculating the percentage, inspectors should remember to add the average percentage of plants that fail to meet size requirements to the average percentage of total defects before subtracting from 100. In reporting the percentage of U.S. No. 1 quality, always use multiples of five preceded by the word "approximately" **except** when the percentage is 86 or more, which would then be reported in exact percentage. Any size specifications other than those specified in the standards shall also be stated. For example, "Approximately 65% U.S. No. 1 quality, 5/32 inch minimum diameter, 5 inches minimum stem length."

Under certain circumstances it will not be possible to attempt to show the percentage of U.S. No. 1 quality plants. For example, when a lot of plants fails to grade U.S. No. 1 due to an excessive number of weed plants in the bunches, no attempt shall be made to show the percentage of U.S. No. 1 quality. A statement that "lot fails to grade U.S. No. 1 on account of excessive number of weed plants" would properly describe such a lot.

Similarly, the percentage of U.S. No. 1 quality shall not be stated when the plants in some containers are badly wilted and the exact percentage cannot be shown. Likewise, if a large percentage of the plants are soft and no exact percentage can be given, no attempt shall be made to certify the percentage of U.S. No. 1 quality.

As a general rule, inspectors shall not attempt to certify the percentage of U.S. No. 1 quality for any failure-to-grade condition where the approximate average percentage of defects and off-size cannot be calculated.

Reporting Percentage of Serious Defects in Connection with Percentage of U.S. No. 1 Quality

It is unlikely that inspectors will encounter many lots at shipping point that have plants affected by decay or other serious defects of a progressive nature. However, if such lots are found, either at shipping point or at terminal markets, and the percentage exceeds the tolerances provided in the grade, the applicant has the right to expect a statement of such percentage in connection with the percentage of U.S. No. 1 quality statement.

Therefore, the inspector shall report the percentage of such serious defects of a progressive nature if they exceed the tolerances. For example, "Approximately 60 percent U.S. No. 1 quality, 6 percent decayed plants, 15 percent badly wilted with leaves turning yellow."

(13) Remarks

Under this heading any explanatory or qualifying statements that are necessary to complete the certificate should be made. They may include one or more of the following:

- Restrictions to a lot, load, or size.
- Information supplied by the applicant such as designation, lot number, etc.
- Cross reference to another certificate number as in re-inspections, appeals, etc.
- Contract specifications.
- Factors not affecting grade at applicant's request.

Appendix I

U.S. Standards

United States Department of Agriculture

Agricultural Marketing Service

United States Standards for Grades of Tomato Plants

As of January 3, 1944

United States Standards for Grades of Tomato Plants [1]

7 CFR 51

Grade

Sec.
2851.4505 U.S. No. 1.

Tolerances
2851.4506 Tolerances.

Standards for Bunching
2851.4507 Standards for bunching.

Standards for Packing
2851.4508 Standards for packing.

Unclassified
2851.4509 Unclassified.

Definitions
2851.4510 Similar varietal characteristics.
2851.4511 Fairly fresh.
2851.4512 Strong.
2851.4513 Unbroken.
2851.4514 Fairly straight.
2851.4515 Firm.
2851.4516 Soft.
2851.4517 Woody.
2851.4518 Leafy.
2851.4519 Normal color.
2851.4520 Damage.
2851.4521 Freezing.
2851.4522 Heating.
2851.4523 Diameter.
2851.4524 The length of the stem.
2851.4525 Length of the main tap root.

Authority: The provisions of this subpart issued under secs. 203, 205, 60 Stat. 1087, as amended, 1090 as amended; 7 U.S.C. 1622, 1624.

Grade

§ 2851.4505 U.S. No. 1.

"U.S. No. 1" consists of tomato plants of similar varietal characteristics which are fairly fresh, strong, and unbroken. The stems shall be fairly straight, firm, but not soft, or woody. The tops shall be leafy, and of normal color. The length of the main tap root shall be not less than 1¾ inches.

(a) The plants shall be free from decay, early blight (Alternaria solani), and bacterial canker (Phytomonas michiganensis), and from damage caused by other diseases, freezing, heating, foreign material, insects, mechanical or other means.

(b) Unless otherwise specified, the diameter of the stem of each plant shall be not less than 3/16 inch and the length of the stem shall be not less than 6 inches nor more than 9 inches. (See § 2851.4506.)

Tolerances

§ 2851.4506 Tolerances.

In order to allow for variations incident to proper grading and handling in the foregoing grade, the following tolerances, by count, are provided as specified:

(a) *For defects.* Ten percent for tomato plants in any lot which fail to meet the requirements of this grade: *Provided,* That no tolerance shall be allowed for decay, early blight (Alternaria solani), or bacterial canker (Phytomonas michiganensis).

(b) *For size.* Ten percent for tomato plants in any lot which fail to meet the specified size requirements, including therein not more than 5 percent for plants which are smaller than the specified minimum diameter.

Standards for Bunching

§ 2851.4507 Standards for bunching.

Tomato plants may be packed loose or in bunches. When bunched, the number of plants per bunch shall average not less than 50 plants in 50-size bunches and not less than 100 plants in 100-size bunches.

Standards for Packing

§ 2851.4508 Standards for packing.

The plants in individual bunches shall be arranged with the tops of the roots in approximately the same plane and the roots shall be protected by an adequate supply of moistened peat moss, sphagnum moss, or other suitable packing material with moisture holding capacity, well scattered over the roots in the bunch and held in place with a paper wrap. The bunches shall be packed upright and fairly tightly in containers of sufficient height to accommodate the size of plants packed and in such a manner as to not cause bending or excessive bruising of the plants.

(a) In order to allow for variations incident to proper packing not more than 10 percent of the containers in any lot may fail to meet the packing requirements.

Unclassified

§ 2851.4509 Unclassified.

"Unclassified" consists of tomato plants which have not been classified in accordance with the foregoing grade. The term "unclassified" is not a grade within the meaning of these standards but is provided as a designation to show that no grade has been applied to the lot.

[1] Compliance with the provisions of these standards shall not excuse failure to comply with the provisions of the Federal Food, Drug and Cosmetic Act, or with applicable State laws and regulations.

Definitions

§ 2851.4510 Similar varietal characteristics.

"Similar varietal characteristics" means that the plants have the same general character of growth and color.

§ 2851.4511 Fairly fresh.

"Fairly fresh" means that the stems, roots and foliage are not excessively wilted, limp, or flabby.

§ 2851.4512 Strong.

"Strong" means that the stem is fairly stiff and sturdy enough to hold the top in a reasonably erect position.

§ 2851.4513 Unbroken.

"Unbroken" means that the stem and that portion of the main tap root remaining on the plant after pulling are not broken.

§ 2851.4514 Fairly straight.

"Fairly straight" means that the stem is not more than moderately curved or crooked.

§ 2851.4515 Firm.

"Firm" means that the stem about midway between the growing tip and the base does not yield more than slightly to moderate pressure of the fingers.

§ 2851.4516 Soft.

"Soft" means that the stem about midway between the growing tip and the base yields more than slightly to moderate pressure of the fingers.

§ 2851.4517 Woody.

"Woody" means that the stem is excessively hard and fibrous.

§ 2851.4518 Leafy.

"Leafy" means that the leaves of the plant are of normal development and not small and underdeveloped.

§ 2851.4519 Normal color.

"Normal color" means that the plant shows a healthy green color.

§ 2851.4520 Damage.

"Damage" means any defect, or any combination of defects, which materially detracts from the normal growth, shipping quality, or general appearance of the plant.

§ 2851.4521 Freezing.

"Freezing" means injury to the plant caused by excessively low temperatures.

§ 2851.4522 Heating.

"Heating" means injury to the plant caused by excessively high temperatures.

§ 2851.4523 Diameter.

"Diameter" means the greatest thickness of the stem measured at the first internode above the cotyledons.

§ 2851.4524 The length of the stem.

"The length of the stem" means the distance from the top of the underground root system to the growing tip of the plant.

§ 2851.4525 Length of the main tap root.

"Length of the main tap root" means the distance from the top of the underground root system to the end of the largest central root.