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**United States
Department of
Agriculture**

Agricultural
Marketing
Service

Fruit and
Vegetable
Division

Processed
Products
Branch

Frozen Leafy Greens

Grading Manual

AD-83 Bookplate
(1-48)

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Frozen Leafy Greens
February 1987

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.

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SAMPLING PROCEDURES

1. LOT (Stationary or moving lot).

Follow → { Regulations (109-A-1)
Sampling Procedures (120-A-1)
Lot Sampling Plan (120-A-7)
Condition of Container (125-A-1)

2. ON-LINE

Follow → { Regulations (109-A-1)
CuSum Sampling Plan (120-A-6)
Time Sampling (120-A-4)
In-Plant Inspection (160-A-1; 162-A-1)
Condition of Container (125-A-1)

NONQUALITY PROCEDURES

1. Time Sampling (120-A-5)
2. Net Weight (128-A-10)
3. Fill of Container (128-A-40)
4. Thawing Procedures (130-A-34)
5. Cooking Procedures (130-A-38)
6. Enzyme Inactivation (135-A-12)

} → Follow 130-A-1

CLASSIFICATION OF DEFECTS

Other than the prerequisite quality factors (such as "brightness," "varietal characteristics," "character," "blemished," and "flavor and odor"), any unit of leafy greens which fails to meet a requirement of the standards is classified as a defect. The defects are classified as "minor," "major," "severe," or "critical". "Total all classes" of defects means "critical," plus "severe," plus "major," plus "minor".

The tolerance for each class of defects is set to AQL's (Acceptable Quality Levels). Usually, the tolerance is the same as the number of defects that would have been allowed in the old U.S. standards, a purchase specification, or other similar buying guide. But, the old tolerance might have been adjusted slightly to consider newer methods of harvesting and processing the product.

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

LEAF STYLE

1. Select at random 300 g (10.6 oz) of leafy greens from the processing line.
2. Evaluate the sample unit for varietal characteristics and assign the letter grade (A or SSTD) in the prerequisites section of the tally sheet.
3. Place the sample unit of leafy greens in water in a deep grading tray. Separate the leaves using gentle agitation.

DO NOT DISCARD THE TRAY OF WATER AS IT WILL BE USED FOR GRIT AND SILT CHECK LATER. (See step 8 of this procedure).

4. For spinach only, determine the weight of stem material in the sample unit.

NOTE: If it is obvious that the sample unit contains no more than 72 grams of stem material and the preceding CuSum value is zero (0), it is unnecessary to determine the number of 12 gram increments. Assign a CuSum value of zero (0) and the letter grade "A" for stem material.

Otherwise, use the following procedure. Separate the leaves with gentle agitation. Remove the individual leaves from the water and cut off the attached stem just below the last point of attachment of leaf material. Place the stem material on a dry, previously tared 8 mesh sieve. Allow the stem material to drain for two (2) minutes, and weigh. Record the number of 12 g increments of stem material (to the nearest 12 g) in the prerequisites section of the tally sheet.

For example:

$$\frac{52 \text{ grams of stem material}}{12 \text{ grams}} = 4.33$$

Record on the tally as 4 increments;

or

$$\frac{56 \text{ grams of stem material}}{12 \text{ grams}} = 4.67$$

Record on the tally as 5 increments.

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

LEAF STYLE (continuation).

Compute the CuSum and assign the letter grade (A, B, or SSTD) for stem material.

CAUTION: SEE "SPECIAL ON-LINE SAMPLING SITUATIONS; USE OF CUSUM PLANS FOR PREREQUISITE QUALITY FACTORS."

	STEM MATERIAL	
	TOLERANCE	
	GRADE A	GRADE B
AQL <u>1</u> /	20.0	25.0

1/ AQL expressed as defects per hundred units. (See Table 7 in File Code 109-A-1, 25 plan)

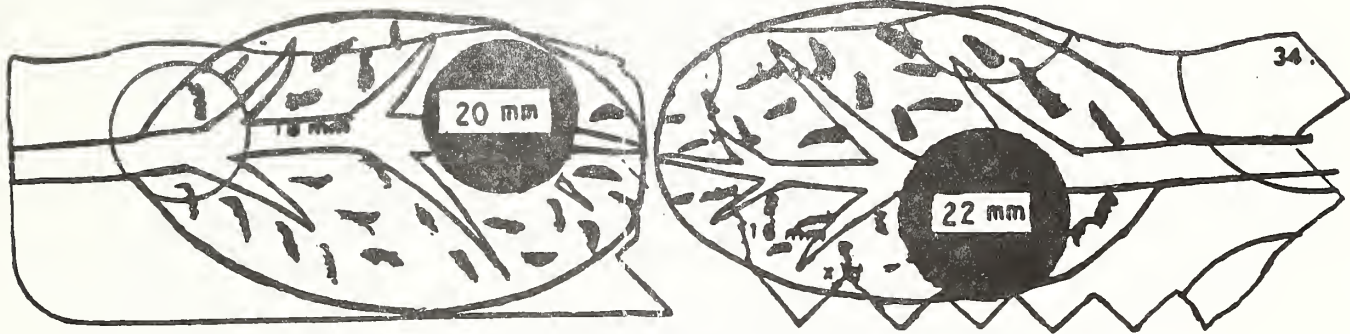
5. Evaluate the sample unit for blemished areas. Any degree of blemish that adversely affects the appearance or eating quality is counted. In other words, for leafy greens other than leaf style spinach, 4 square centimeters (cm²) of dark brown discoloration (serious) would be recorded as one blemished just as 4 cm² of yellow discoloration (slight) would be recorded as one blemished. Determine the aggregate area of the blemished portions. Record in the prerequisites section of the tally sheet the number of 4 cm² increments (to the nearest 4 cm²). For leaf style spinach, each 6 cm² is counted as one defect (instead of each 4 cm²).

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

LEAF STYLE (continuation).

5a. Blemished (continuation).

For example, if you found the following blemished areas:

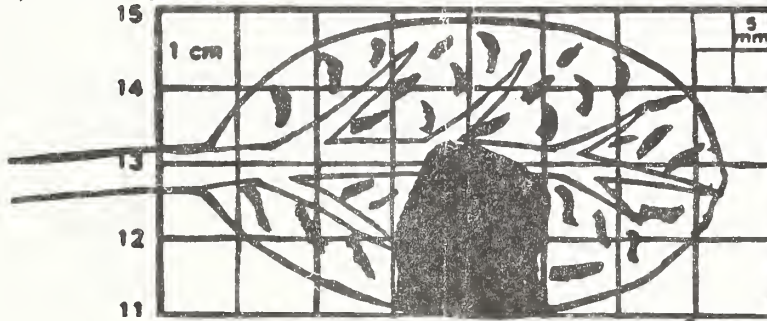


$$\text{Area} = \pi r^2 = 3.14 \times 1.0^2$$

$$\text{Area} = 3.14 \text{ cm}^2$$

$$\text{Area} = \pi r^2 = 3.14 \times 1.1^2$$

$$\text{Area} = 3.80 \text{ cm}^2$$



$$\text{Area} = L \times W = 2 \text{ cm} \times 2 \text{ cm} = 4 \text{ cm}^2.$$

$$\text{Aggregate area} = 3.14 \text{ cm}^2 + 3.80 \text{ cm}^2 + 4 \text{ cm}^2 = 10.94 \text{ cm}^2.$$

The number of 4 cm^2 increments (to the nearest 4 cm^2) equals $10.94 \text{ cm}^2 \div 4 \text{ cm}^2 = 2.74 = 3$ increments. You would record this as 3 blemished in the prerequisites section of the tally sheet.

Compute the CuSum and assign the letter grade for blemished.

5b. If you are grading spinach, 6 square centimeters would be recorded as one blemished. Follow the procedure as described in 5a but record the number of 6 cm^2 increments (to the nearest 6 cm^2) in the prerequisite section of the tally sheet. For example, the aggregate area determined in step 5a of 10.94 cm^2 would be recorded as $10.94 \text{ cm}^2 \div 6 \text{ cm}^2 = 1.82 = 2$ increments. Compute the CuSum and assign the letter grade for blemished.

CAUTION: SEE "SPECIAL ON-LINE SAMPLING SITUATIONS; USE OF CUSUM PLANS FOR PREREQUISITE QUALITY FACTORS."

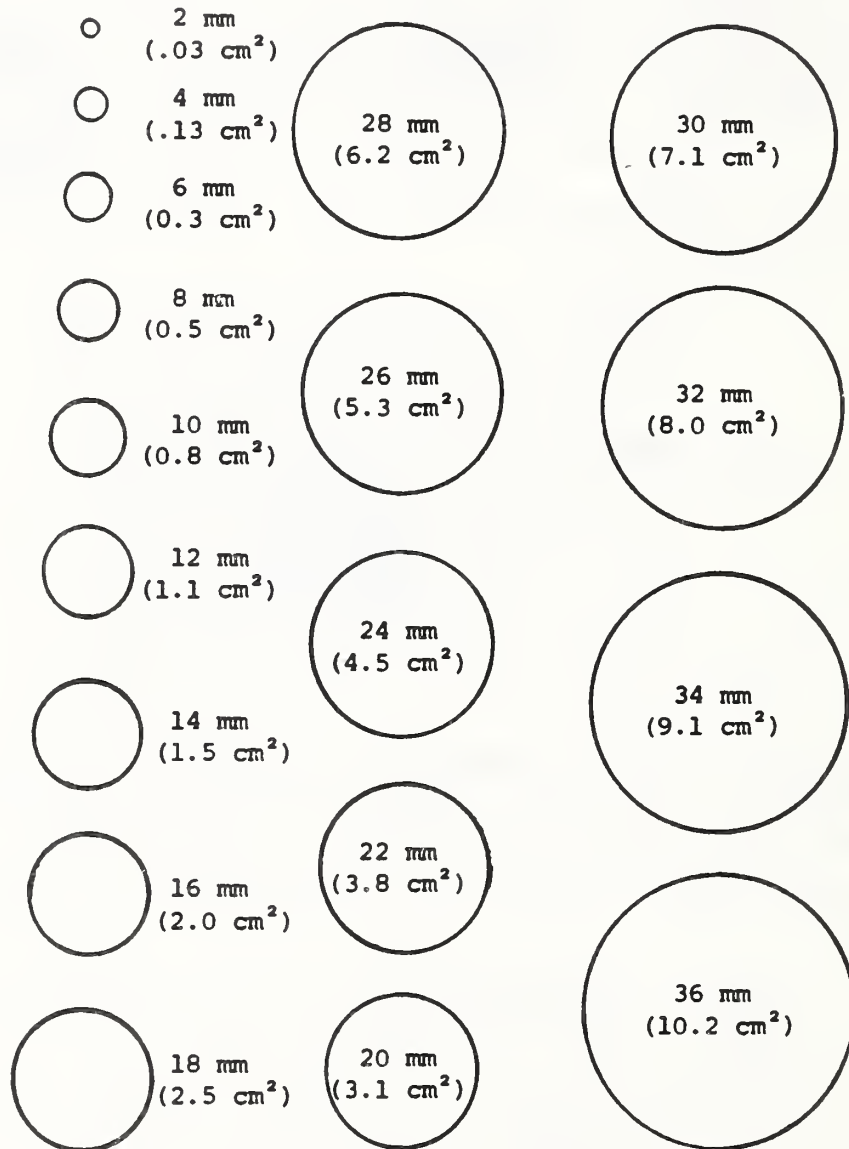
(See next page)

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

LEAF STYLE (continuation).

TIMESAVER: To save time in computing area measurements of circular blemishes, you could use the following adaptation of Inspection Aid No. 101 as a guide.

MILLIMETER DIAMETER
(square centimeters)



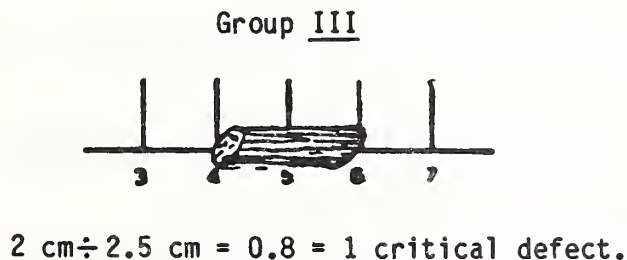
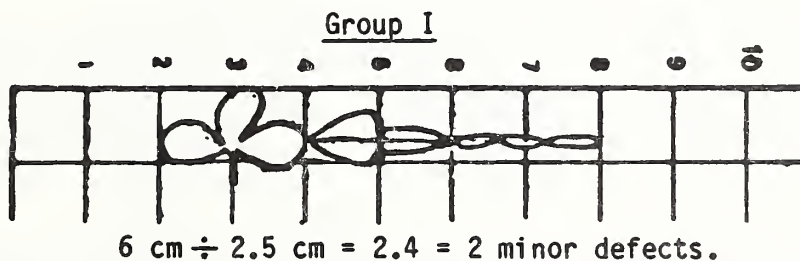
SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

LEAF STYLE (continuation).

6. Evaluate the sample unit for root crowns, root stubs, and seed heads. Count and record on the tally sheet under classified defects each piece of root crown and root stub; and seed heads that are longer than 2.5 cm (1 in) or objectionable in appearance.
7. Remove all extraneous vegetable material (EVM) from the sample unit. Use the definitions in the standards to group the EVM into "I," "II," and "III". Determine the aggregate length of the EVM in each group. Record the number of 2.5 cm increments of EVM (to the nearest 2.5 cm) for each group in the classified defects section of the tally sheet.

For example:

These defects should be classified and recorded as follows:



SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

LEAF STYLE (continuation).

8. Remove any remaining leaf and stem material from the tray of water saved in step 3 of this procedure, carefully pour off the water and recover the sediment in a 250 ml beaker. Add water and bring the beaker to about 1/2 of its volume. If grit is detected in the sediment, cook a separate sample unit according to USDA cooking instructions. If grit is only slightly noticeable, classify as Grade A. If grit is more than slightly noticeable, but not objectionable, classify as Grade B. If objectionable, classify as SStd. For product containing soil or silt that is not gritty, and the appearance or eating quality is not more than slightly affected, classify the product as Grade A. If the appearance or eating quality is more than slightly, but not seriously affected, classify the product as Grade B. If seriously affected, classify the product SStd.
9. Total the classes of defects on the tally sheet and compute the CuSum values as outlined in File Code 120-A-6.
10. Select at least one standard sample unit size (300 g) for each production period code. This sample unit is to be selected after the greens have been frozen. It may comprise one container or multiple containers. (See Special On-Line Sampling Situations -- Checking "Frozen Prerequisites").
11. Open the container(s) and allow the product to thaw slightly. This will reduce unnecessary breakage of the greens when they are removed from the container(s).
12. Place the greens in warm water in a deep grading tray. With gentle agitation separate the leaves.
13. Evaluate the sample unit for brightness. Record the letter grade for brightness as "A", "B," or "SSTD" in the prerequisites section of the tally sheet.
14. Cook a portion of the sample unit, according to Branch instructions for cooking frozen vegetables, to evaluate flavor and odor. Include, in the portion to be cooked, any "suspect" units that could impart an off-flavor or odor. Assign the letter grade (A or SSTD) for flavor and odor in the prerequisites section of the tally sheet.

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

LEAF STYLE (continuation).

15. Also, evaluate the character of the cooked sample unit. Please be careful to evaluate character based on the "type" of leafy greens. For example, mustard greens are expected to be more difficult to chew than spinach. They should not be downgraded if the character is typical of grade A mustard greens. Assign the letter grade (A, B, or SSTD) for character in the prerequisites section of the tally sheet.

CAUTION: DO NOT ADD TO THE DEFECT TALLY ANY CLASSIFIED DEFECTS FOUND DURING EXAMINATION OF THE LEAFY GREENS FOR "FROZEN PREREQUISITES" FACTORS.

16. Occasionally, equipment breakdown (flo-freeze unit, etc.) causes product deterioration. If the defective product is isolated, separately identified and set aside, don't count it as a portion of the production that is being run.
17. Optionally, the entire evaluation of the sample unit and the classification of defects may be made on the product directly out of the freezer. Use CuSum, but bypass the selection of the sample unit from the production line prior to freezing.

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

CHOPPED STYLE

1. Select at random 300 g (10.6 oz) of leafy greens from the processing line. Use a sample unit size of 75 g (2.65 oz) to evaluate all quality factors except grit or silt. Save the 225 g balance for step 7 of this procedure.
2. Evaluate the sample unit for varietal characteristics and assign the letter grade (A or SSTD) in the prerequisites section of the tally sheet.
3. Place the sample unit of leafy greens (75 g) in water in a deep grading tray. Separate the greens using gentle agitation.

DO NOT DISCARD THE TRAY OF WATER. IT AND THE 225 G OF GREENS NOT USED IN STEPS 4, 5, AND 6 WILL BE USED FOR GRIT AND SILT CHECK LATER. (SEE STEP 7 OF THIS PROCEDURE.)

4. For chopped spinach only, evaluate the sample unit for stem material. Assign the letter grade (A, B or SSTD) for stem material in the prerequisites section of the tally sheet.

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

CHOPPED STYLE (continuation).

5. Evaluate the sample unit for blemished areas. Any degree of blemish that adversely affects the appearance or eating quality is counted. In other words, 2 square centimeters (cm^2) of dark brown discoloration (serious) would be recorded as one blemished just as 2 cm^2 of yellow discoloration (slight) would be recorded as one blemished. Determine the aggregate area of the blemished portions. Record in the prerequisites section of the tally sheet the number of 2 cm^2 increments (to the nearest 2 cm^2).

For example, if you found the following blemished areas:



Area = 0.5 cm^2



Area = 0.75 cm^2



Area = 1.0 cm^2



Area = 0.5 cm^2



Area = 0.5 cm^2



Area = 0.25 cm^2

(See next page)

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

CHOPPED STYLE (continuation).

5. Blemished (continuation).

Aggregate area = $0.5 + 0.75 + 1.0 + 0.5 + 0.5 + 0.25 = 3.5 \text{ cm}^2$.

The number of 2 cm^2 increments (to the nearest 2 cm^2) = $3.5 \text{ cm}^2 \div 2 \text{ cm}^2 = 1.75 = 2$ increments. You would record this as 2 blemished in the prerequisites section of the tally sheet.

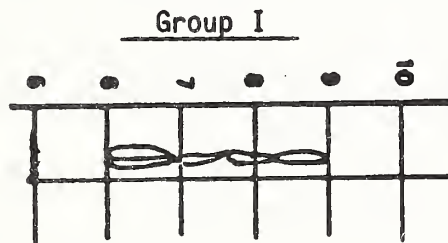
Compute the CuSum and assign the letter grade for blemished.

CAUTION: SEE "SPECIAL ON-LINE SAMPLING SITUATIONS; USE OF CUSUM PLANS FOR PREREQUISITE QUALITY FACTORS."

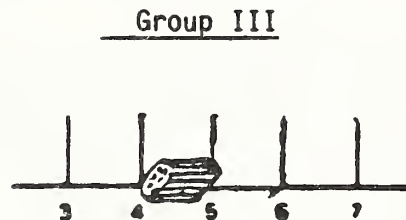
6. Remove all extraneous vegetable material (EVM) from the sample unit. Use the definitions in the standards to group the EVM into "I," "II," and "III". Determine the aggregate length of the EVM in each group. Record the number of 1.3 cm increments of EVM (to the nearest 1.3 cm) for each group in the classified defects section of the tally sheet.

For example:

These defects should be classified and recorded as follows:



$3 \text{ cm} \div 1.3 \text{ cm} = 2.3 = 2$ minor defects.



$1 \text{ cm} \div 1.3 \text{ cm} = 0.77 = 1$ critical defect.

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

CHOPPED STYLE (continuation).

7. Add the 225 g of greens saved in Step 1 of this procedure to the tray of water set aside in Step 3 and agitate gently. Then, remove all remaining leaf and stem material from the tray, carefully pour off the water and recover the sediment in a 250 ml beaker. Add water and bring the beaker to about 1/2 of its volume.

If grit is detected in the sediment, cook a separate sample unit according to Branch cooking instructions. If grit is only slightly noticeable, classify as Grade A. If grit is more than slightly noticeable, but not objectionable, classify as Grade B. If objectionable, classify as SSTD. For product containing soil or silt that is not gritty and the appearance or eating quality is not more than slightly affected, classify as Grade A. If the appearance or eating quality is more than slightly, but not seriously affected, classify as Grade B. If seriously affected, classify as SSTD.

8. Total the classes of defects on the tally sheet and compute the CuSum values as outlined in File Code 120-A-6.
9. Select at least one standard sample unit size (75 g) for each production period code. This sample unit is to be selected after the greens have been frozen. It may comprise one container or multiple containers. (See Special On-Line Sampling Situations -- Checking "Frozen Prerequisites").
10. Open the container(s) and allow the product to thaw slightly. This will reduce unnecessary breakage of the greens when they are removed from the container(s).
11. Place the greens in warm water in a deep grading tray. With gentle agitation separate the greens.
12. Evaluate the sample unit for brightness. Record the letter grade for brightness (A, B, or SSTD) in the prerequisites section of the tally sheet.
13. Cook a portion of the sample unit according to Branch instructions for cooking frozen vegetables, to evaluate flavor and odor. Include, in the portion to be cooked, any "suspect" units that could impart an off flavor or odor. Assign the letter grade (A or SSTD) for flavor and odor in the prerequisites section of the tally sheet.

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

CHOPPED STYLE (continuation).

14. Also, evaluate the character of the cooked sample unit. Please be careful to evaluate character based on the "type" of leafy greens. For example, mustard greens are expected to be more difficult to chew than spinach. They should not be downgraded if the character is typical of A grade mustard greens. Assign the letter grade (A, B, or SSTD) for character in the prerequisites section of the tally sheet.

CAUTION: DO NOT ADD TO THE DEFECT TALLY ANY CLASSIFIED DEFECTS FOUND DURING EXAMINATION OF THE LEAFY GREENS FOR "FROZEN PREREQUISITES" FACTORS.

15. Occasionally, equipment breakdown (flo-freeze unit, etc.) causes product deterioration. If the defective product is isolated, separately identified and set aside, don't count it as a portion of the production that is being run.
16. Optionally, the entire evaluation of the sample unit and the classification of defects may be made on the product directly out of the freezer. Use CuSum, but bypass the selection of the sample unit from the production line prior to freezing.

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

PUREED STYLE

1. Select at random 75 g (2.65 oz) of leafy greens from the processing line.
2. Evaluate the sample unit for varietal characteristics and assign the letter grade (A or SSTD) in the prerequisites section of the tally sheet.
3. Pour and spread the product evenly over the bottom of a shallow white tray. Count the number of dark specks. Each two (2) specks is equal to one blemished. Record in the prerequisites section of the tally sheet the number of blemished.

Compute the CuSum and assign the letter grade for blemished.

CAUTION: SEE "SPECIAL ON-LINE SAMPLING SITUATIONS;
USE OF CUSUM PLANS FOR PREREQUISITE QUALITY
FACTORS."

4. Remove all extraneous vegetable material (EVM) from the sample unit. Use the definitions in the standards to group the EVM into "I," "II," and "III". Determine the aggregate length of the EVM in each group. Record the number of 1.3 cm increments of EVM (to the nearest 1.3 cm) for each group in the classified defects section of the tally sheet.

For example:

The number of defects should be determined as follows:

$$3 \text{ cm (aggregate length)} \div 1.3 \text{ cm} = 2.3 = 2 \text{ defects.}$$

$$1 \text{ cm (aggregate length)} \div 1.3 \text{ cm} = 0.77 = 1 \text{ defect.}$$

5. Evaluate the sample unit for grit or silt by chewing. Assign the letter grade (A, B, or SSTD) for grit or silt in the prerequisites section of the tally sheet.
6. Total the classes of defects on the tally sheet and compute the CuSum values as outlined in File Code 120-A-6.

SUGGESTED ORDER FOR ON-LINE GRADING OF A SAMPLE UNIT

PUREED STYLE (continuation)

7. Select at least one standard sample unit size (75g) for each production period code. This sample unit is to be selected after the greens have been frozen. It may comprise one container or multiple containers. (See Special On-Line Sampling Situations -- Checking "Frozen Prerequisites").
8. Thaw the product according to Branch instructions for thawing frozen vegetables in sealed packages.
9. Evaluate the sample unit for brightness. Record the letter grade for brightness (A, B, or SSTD) in the prerequisites section of the tally sheet.
10. Cook a portion of the sample unit according to Branch instructions for cooking frozen vegetables, to evaluate flavor and odor. Assign the letter grade (A or SSTD) for flavor and odor in the prerequisites section of the tally sheet.

CAUTION: DO NOT ADD TO THE DEFECT TALLY ANY CLASSIFIED DEFECTS FOUND DURING EXAMINATION OF THE LEAFY GREENS FOR "FROZEN PREREQUISITES" FACTORS.

11. Occasionally, equipment breakdown (flo-freeze unit, etc.) causes product deterioration. If the defective product is isolated, separately identified and set aside, don't count it as a portion of the production that is being run.
12. Optionally, the entire evaluation of the sample unit and the classification of defects may be made on the product directly out of the freezer. Use CuSum, but bypass the selection of the sample unit from the production line prior to freezing.

SPECIAL ON-LINE SAMPLING SITUATIONS

1. CHECKING "FROZEN PREREQUISITES".

Several prerequisite quality factors (such as flavor and odor) should be checked after freezing. If the other quality factors are evaluated from sample units drawn from the processing line (prior to freezing) you should evaluate at least one standard sample unit size (300 g or 75 g) for each production period code. Because the product may be inaccessible once it is warehoused, draw enough containers from the production line (frozen) to satisfy the requirements of increased sampling, should you need the additional containers. Any unopened containers could be returned to the freezer storage. Your check might be done as follows:

- a. Draw at least one standard sample unit size for each 30 minutes of production. Mark the time. Evaluate one sample unit size from the period code. Accept the period if the sample unit meets the intended grade. Open and evaluate the additional sample units from the period code in question if the first one fails. Allow a failure to occur at the rate in File Code 120-A-4 for time sampling deviants. If a failure does occur, the recorded time of the "frozen prerequisites" check could be used to pinpoint the portion of the period code containing the problem; or
- b. Draw at least one container for each 30 minutes of production. Make sure that you have enough product for one standard sample unit size from each period code. Composite all of the product from the period code and select at random one standard sample unit size for examination. The period code would pass or fail based on just one check. If a failure does occur, the exact time, or portion of the period code containing the problem could not be pinpointed.

2. USE OF CUSUM PLANS FOR PREREQUISITE QUALITY FACTORS.

Consider prerequisite quality factors independent of the classified quality factors. Although the prerequisite quality factors of stem material and blemished are set to AQLs and appropriate CuSum sampling plans, don't use the CuSum rules in File Code 120-A-6 for these prerequisites, except for assigning a grade to the period code. (Example: If 2 sample units in a row fail the designated grade, don't apply step 3 of HOW TO INSPECT PRODUCTION in File Code 120-A-6).

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

LEAF STYLE

1. Follow the procedure outlined in File Code 120-A-7, Lot Single Sampling Plan (Attributes).
2. Use the same defect tally sheet for lot grading as you would use for on-line grading. Ignore the section of the tally devoted to CuSum values.

NOTE: THE FOLLOWING PREREQUISITES ARE TO BE EVALUATED ON A CONTAINER-BY-CONTAINER BASIS: BRIGHTNESS; VARIETAL CHARACTERISTICS; GRIT OR SILT; ODOR (Tentative).

3. Weigh and record the net weight of each container.
4. Open each container and allow the product to thaw slightly. This will reduce further breakage of the greens when they are taken from the container.
5. Carefully remove the greens from each container. Place them container by container into deep grading trays to thaw according to Branch instructions for thawing frozen vegetables.
6. With gentle agitation separate the leaves. Remove the greens from the water. TEMPORARILY SET ASIDE EACH TRAY OF WATER FOR SUBSEQUENT GRIT AND SILT CHECK. (See step 15 of this procedure).
7. Spread the greens on shallow grading trays and evaluate on a container by container basis the following prerequisites:
 - a. Evaluate "brightness" and record the letter grade (A, B or SSTD) in the prerequisites section of the tally sheet;
 - b. Assign the letter grade (A or SSTD) for "varietal characteristics" in the section for prerequisites;
 - c. Evaluate the greens for "odor". Any container with product "suspect" of having an off-odor should be retained for evaluation of flavor and odor at a later step in this procedure. The "suspect" greens should be kept physically separate from the other containers, but must be evaluated for classified defects before cooking. If no off-odor is detected, tentatively assign the letter grade "A" for flavor and odor in the prerequisites section of the defect tally.

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

LEAF STYLE (continuation).

8. Assemble mentally or physically (except any "suspect" off-odor greens as mentioned in step 7) all of the greens from all of the containers into one sample. Adjust the total weight of the leafy greens to equal one of the following sample sizes:

See 120-A-7 Supplement 1, 300 grams/25 plan = 12 gram increments

936 g (33.0 oz) 78x12	1512 g (53.3 oz) 126x12	1800 g (63.5 oz) 150x12	2028 g (71.5 oz) 169x12
2088 g (73.6 oz) 174x12	3276 g (115.6 oz) 273x12	3600 g (127.0 oz) 300x12	3900 g (137.6 oz) 325x12
4524 g (159.6 oz) 377x12	6300 g (222.2 oz) 525x12	7200 g (254.0 oz) 600x12	7800 g (275.1 oz) 650x12
8700 g (306.9 oz) 725x12	The acceptance numbers for 3276 grams of product are found in Supplement 1 under column "273", for example.		

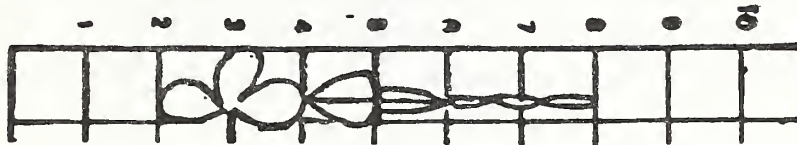
9. Evaluate the sample for root crowns, root stubs, and seed heads. Count and record on the tally sheet under classified defects each piece of root crown and root stub; and seed heads that are longer than 2.5 cm (1 in) or objectionable in appearance.
10. Remove all extraneous vegetable material (EVM) from the sample. Use the definitions in the standards to group the EVM into "I," "II," and "III". Determine the aggregate length of the EVM in each group. Record the number of 2.5 cm increments of EVM (to the nearest 2.5 cm) for each group in the classified defects section of the tally sheet. (Please see example on the next page).

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

LEAF STYLE (continuation).

10. EVM (continuation).

Group I



$$6 \text{ cm} \div 2.5 \text{ cm} = 2.4 = 2 \text{ minor defects.}$$

Group III



$$2 \text{ cm} \div 2.5 \text{ cm} = 0.8 = 1 \text{ critical defect.}$$

11a. Evaluate the sample for blemished areas. Any degree of blemish that adversely affects the appearance or eating quality is counted. In other words for leafy greens other than spinach, 4 square centimeters (cm²) of dark brown discoloration (serious) would be recorded as one blemished just as 4 cm² of yellow discoloration (slight) would be recorded as one blemished. Determine the aggregate area of the blemished portions. Record in the prerequisites section of the tally sheet the number of 4 cm² increments (to the nearest 4 cm²). For leaf style spinach, each 6 cm² is counted as one defect (instead of each 4cm²).

For example, if you found the following blemished areas:



$$\begin{aligned} \text{Area} &= \pi r^2 = 3.14 \times (1.0)^2 \\ \text{Area} &= 3.14 \text{ cm}^2 \end{aligned}$$



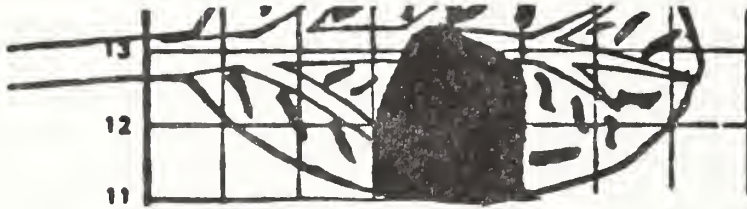
$$\begin{aligned} \text{Area} &= \pi r^2 = 3.14 \times (1.1)^2 \\ \text{Area} &= 3.80 \text{ cm}^2 \end{aligned}$$

(See next page)

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

LEAF STYLE (continuation).

11a. Blemished (continuation).



$$\text{Area} = L \times W = 2 \text{ cm} \times 2 \text{ cm} = 4 \text{ cm}^2.$$

$$\text{Aggregate area} = 3.14 \text{ cm}^2 + 3.80 \text{ cm}^2 + 4 \text{ cm}^2 = 10.94 \text{ cm}^2.$$

The number of 4 cm^2 increments (to the nearest 4 cm^2) = $10.94 \text{ cm}^2 \div 4 \text{ cm}^2 = 2.74 = 3$ increments. You would record this as 3 blemished in the prerequisites section of the tally sheet. Assign the letter grade (A, B, or SSTD) for blemished based on the tolerances shown below in the Prerequisites section of the tally sheet.

11b. If you are grading spinach, 6 square centimeters would be recorded as one blemished. Follow the procedure as described in 11a but record the number of 6 cm^2 increments (to nearest 6 cm^2) in the prerequisite section of the tally sheet.

For example, the aggregate area determined in step 11a of 10.94 cm^2 would be recorded as $10.94 \text{ cm}^2 \div 6 \text{ cm}^2 = 1.82 = 2$ increments. Assign the letter grade (A, B, or SSTD) for blemished based on the tolerances shown below.

Lot Tolerance for Blemished
(number of 4 cm^2 or 6 cm^2 increments)

Sample size (grams)	A	B	Sample size (grams)	A	B
936	22	40	3900	78	149
1512	33	62	4524	90	171
1800	39	73	6300	122	234
2028	43	81	7200	138	266
2088	44	83	7800	149	287
3276	67	126	8700	165	318
3600	73	138			

For leaf style spinach, use the table above, however, each defect for blemishes will be based on 6 cm^2 increments.

(See next page)

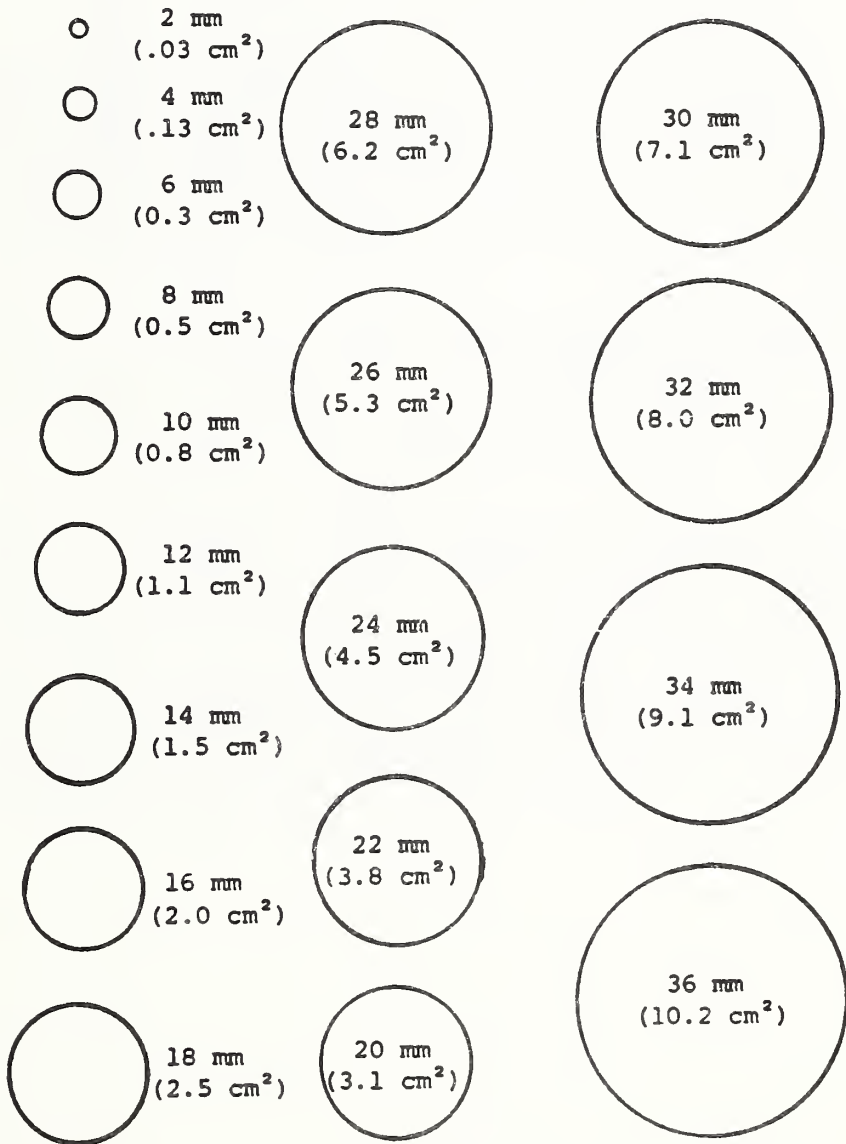
SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

LEAF STYLE (continuation).

11. Blemished (continuation).

TIMESAVER: To save time in computing area measurements of circular blemishes, you could use the following adaptation of Inspection Aid No. 101 as a guide.

MILLIMETER DIAMETER
(square centimeters)



SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

LEAF STYLE (continuation).

12. For spinach only, determine the weight of stem material in the sample. Time Saver: If you are using a larger sample for classified quality defects, you may use a smaller sample for weighing stem material. This option would be equal to drawing a subsample. For example, if you are using a 6300 g (222.2 oz) sample for classified defects, you could choose a smaller sample size for stem material such as 936 g (33.0 oz); 1512 g (53.3 oz); or 1800 g (63.5 oz), etc. If you use a smaller sample size for weighing stem material, note on the tally sheet that you used the smaller sample. Otherwise, it is difficult for someone else to re-evaluate the defect tally.

Use the following procedure. Remove the individual leaves from the tray and cut off the attached stem just below the last point of attachment of leaf material. Place the stem material on a dry, previously tared 8 mesh sieve. Allow the stem material to drain for two (2) minutes, and weigh. Record the number of 12 g increments of stem material (to the nearest 12 g) in the prerequisites section of the tally sheet.

For example:

$$\frac{52 \text{ grams of stem material}}{12 \text{ grams}} = 4.33$$

Record on the tally as 4 increments;

or

$$\frac{56 \text{ grams of stem material}}{12 \text{ grams}} = 4.67$$

Record on the tally as 5 increments.

Assign the letter grade (A, B, or SSTD) for stem material based on the tolerance shown on the next page.

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

LEAF STYLE (continuation).

12. Spinach stem material (continuation).

Spinach Stem Material
Lot Tolerance
(number of 12 g increments)

Sample size (grams)	A	B	Sample size (grams)	A	B
936	22	27	3900	78	96
1512	33	41	4524	90	110
1800	39	48	6300	122	150
2028	43	53	7200	138	170
2088	44	54	7800	149	183
3276	67	82	8700	165	203
3600	73	89			

13. Cook a portion of the sample, according to Branch instructions for cooking frozen vegetables, to evaluate flavor and odor. NOTE: Cook separately any "suspect" off-odor greens retained in step 7 c of this procedure. If the "suspect" greens have a normal flavor and odor after cooking, they should be assigned grade "A" for "flavor and odor". Assign the letter grade (A or SSTD) for the sample (not each container) for "flavor and odor" in the "prerequisites" section of the tally sheet.
14. Also, evaluate the character of the cooked sample. Please be careful to evaluate character based on the "type" of leafy greens. For example, mustard greens are expected to be more difficult to chew than spinach. They should not be downgraded if the character is typical of A grade mustard greens. Assign the letter grade (A, B, or SSTD) for character in the prerequisites section of the defect tally.
15. Discard container by container most of the contents of each tray of water saved in step 6 of this procedure. Recover the sediment from each tray in a 250 ml beaker.

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

LEAF STYLE (continuation).

16. Add water and bring each beaker to about 1/2 of its volume. If grit is detected in the sediment, cook a separate sample unit according to Branch cooking instructions. If grit is only slightly noticeable, classify as Grade A. If grit is more than slightly noticeable, but not objectionable, classify as Grade B. If objectionable, classify as SSTD. For product containing soil or silt that is not gritty and the appearance or eating quality is not more than slightly affected, classify as Grade A. If the appearance or eating quality is more than slightly, but not seriously affected, classify as Grade B. If seriously affected, classify as SSTD.
17. Compare the total number of defects that you found in the sample (not each container) with the acceptance number for the applicable AQL and sample size in File Code 120-A-7, Supplement I.
18. Assign a grade to the sample based on the procedure outlined in File Code 120-A-7, Lot Single Sampling Plan.

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

CHOPPED STYLE

1. Follow the procedure outlined in File Code 120-A-7, Lot Single Sampling Plan (Attributes).
2. Use the same defect tally sheet for lot grading as you would use for on-line grading. Ignore the section of the tally devoted to CuSum values.

NOTE: THE FOLLOWING PREREQUISITES ARE TO BE EVALUATED ON A CONTAINER BY CONTAINER BASIS: BRIGHTNESS VARIETAL CHARACTERISTICS; GRIT OR SILT; ODOR (Tentative).

3. Weigh and record the net weight of each container.
4. Open each container and allow the product to thaw slightly.
5. Carefully remove the greens from each container. Place them container by container into deep grading trays to thaw according to Branch instructions for thawing frozen vegetables.
6. With gentle agitation separate the leaves. Remove the greens from the water. TEMPORARILY SET ASIDE EACH TRAY OF WATER FOR SUBSEQUENT GRIT AND SILT CHECK. (See step 14 of this procedure).
7. Spread the greens on shallow grading trays and evaluate on a container by container basis the following prerequisites:
 - a. Evaluate "brightness" and record the letter grade (A, B, or SSTD) in the prerequisites section of the tally sheet;
 - b. Assign the letter grade (A or SSTD) for "varietal characteristics" in the section for prerequisites;
 - c. Evaluate the greens for "odor". Any container with product "suspect" of having an off-odor should be retained for evaluation of flavor and odor at a later step in this procedure. The "suspect" greens should be kept physically separate from the other containers, but must be evaluated for classified defects before cooking. If no off-odor is detected, tentatively assign the letter grade "A" for flavor and odor in the prerequisites section of the tally sheet.

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

CHOPPED STYLE (continuation).

8. Assemble mentally or physically (except any "suspect" off-odor greens as mentioned in step 7c) all of the greens from all of the containers into one sample. Adjust the total weight of the leafy greens to equal one of the following sample sizes:

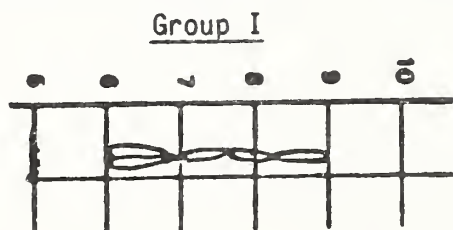
See 120-A-7, Supplement 1, 75 grams/25plan = 3 gram increments.

108 g (3.8 oz) 36x3	234 g (8.3 oz) 78x3	378 g (13.3 oz) 126x3	450 g (15.9 oz) 150x3
507 g (17.9 oz) 169x3	522 g (18.4 oz) 174x3	819 g (28.9 oz) 273x3	900 g (31.7 oz) 300x3
975 g (34.4 oz) 325x3	1131 g (39.9 oz) 377x3	1575 g (55.6 oz) 525x3	1800 g (63.5 oz) 600x3
1950 g (68.8 oz) 650x3	2175 g (76.7 oz) 725x3	The acceptance numbers for 819 grams of product are found in Supplement 1, under column "273", for example.	

9. Remove all extraneous vegetable material (EVM) from the sample. Use the definitions in the standards to group the EVM into "I," "II" and "III". Determine the aggregate length of the EVM in each group. Record the number of 1.3 cm increments of EVM (to the nearest 1.3 cm) for each group in the classified defects section of the tally sheet.

For example:

These defects should be classified and recorded as follows:



$$3 \text{ cm} \div 1.3 \text{ cm} = 2.3 = 2 \text{ minor defects.}$$

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

CHOPPED STYLE (continuation).

Group III



1 cm -- 1.3 cm = 0.77 = 1 critical defect.

10. Evaluate the sample for blemished areas. Any degree of blemish that adversely affects the appearance or eating quality is counted. In other words, 2 square centimeters (cm^2) of dark brown discoloration (serious) would be recorded as one blemished just as 2 cm^2 of yellow discoloration (slight) would be recorded as one blemished. Determine the aggregate area of the blemished portions. Record in the prerequisites section of tally sheet under classified defects the number of 2 cm^2 increments (to the nearest 2 cm^2).

For example, if you found the following blemished areas:



Area = 0.5 cm^2



Area = 0.75 cm^2



Area = 1.0 cm^2



Area = 0.5 cm^2



Area = 0.5 cm^2



Area = 0.25 cm^2

Aggregate area = 0.5 + 0.75 + 1.0 + 0.5 + 0.5 + 0.25 = 3.5 cm^2 .

The number of 2 cm^2 increments (to the nearest 2 cm^2) = 3.5 $\text{cm}^2 \div 2 \text{ cm}^2 = 1.75 = 2$ increments. You would record this as 2 blemished in the prerequisites section of the tally sheet.

(See next page)

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

CHOPPED STYLE (continuation).

10. Blemished (continuation).

Assign the letter grade (A, B or SSTD) for blemished based on the tolerance shown below.

Lot Tolerance for Blemished
(number of 2 cm² increments)

Sample size (grams)	A	B	Sample size (grams)	A	B
108	12	21	900	73	138
234	22	40	975	78	149
378	33	62	1131	90	171
450	39	73	1575	122	234
507	43	81	1800	138	266
522	44	83	1950	149	287
819	67	126	2175	165	318

11. For chopped spinach only, evaluate the sample for stem material. Assign the letter grade (A, B, or SSTD) for stem material in the prerequisites section of the tally sheet.
12. Cook a portion of the sample, according to Branch instructions for cooking frozen vegetables, to evaluate flavor and odor. NOTE: Cook separately any "suspect" off-odor greens retained in step 7 c of this procedure. If the "suspect" greens have a normal flavor and odor after cooking, they should be assigned grade "A" for "flavor and odor". Assign the letter grade (A or SSTD) for the sample (not each container) for "flavor and odor" in the "prerequisites" section of the defect tally.
13. Also, evaluate the character of the cooked sample. Please be careful to evaluate character based on the "type" of leafy green. For example, mustard greens are expected to be more difficult to chew than spinach. They should not be downgraded if the character is typical of A grade mustard greens. Assign the letter grade (A, B, or SSTD) for character in the prerequisites section of the defect tally.
14. Discard, container by container, most of the contents of each tray of water saved in step 6 of this procedure. Recover the sediment tray by tray in 250 ml beakers.

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

CHOPPED STYLE (continuation).

15. Add water and bring each beaker to about 1/2 of its volume. If grit is detected in the sediment, cook a separate sample unit accordingly to Branch cooking instructions. If grit is only slightly noticeable, classify as Grade A. If grit is more than slightly noticeable, but not objectionable, classify as Grade B. If objectionable, classify as SSTD. For product containing soil or silt that is not gritty and the appearance or eating quality is not more than slightly affected, classify as Grade A. If the appearance or eating quality is more than slightly, but not seriously affected, classify as Grade B. If seriously affected, classify as SSTD.
16. Compare the total number of defects that you found in the sample (not each container) with the acceptance number for the applicable AQL and sample size in File Code 120-A-7, Supplement I.
17. Assign a grade to the sample based on the procedure outlined in File Code 120-A-7, Lot Single Sampling Plan.

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

PUREED STYLE

1. Follow the procedure outlined in File Code 120-A-7, Lot Single Sampling Plan (Attributes).
2. Use the same tally sheet for lot grading as you would for on-line grading. Ignore the section of the tally devoted to CuSum values.

NOTE: THE FOLLOWING PREREQUISITES ARE TO BE EVALUATED ON A CONTAINER BY CONTAINER BASIS: BRIGHTNESS; VARIETAL CHARACTERISTICS; GRIT OR SILT; and ODOR (Tentative).

3. Weigh and record the net weight of each container.
4. Thaw the product according to Branch instructions for thawing frozen vegetables in sealed packages.
5. Pour the product, container by container, or a representative sub sample from each container, into shallow white bottom trays and spread the product evenly over the bottoms of the trays.
6. On a container by container basis:
 - a. Evaluate "brightness" and record the letter grade (A, B, or SSTD) in the prerequisites section of the tally sheet;
 - b. Assign the letter grade (A or SSTD) for "varietal characteristics" in the section for prerequisites;
 - c. Evaluate the greens for "odor". Any container with product "suspect" of having an off-odor should be retained for evaluation of flavor and odor at a later step in this procedure. The "suspect" greens should be kept physically separate from the other containers, but must be evaluated for classified defects before cooking. If no off-odor is detected, tentatively assign the letter grade "A" for flavor and odor in the prerequisites section of the tally sheet.
 - d. Evaluate the greens for grit or silt by chewing. Assign the letter grade (A, B, or SSTD) for grit or silt in the prerequisites section of the tally sheet.

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

PUREED STYLE (continuation).

7. Assemble mentally or physically (except any "suspect" off-odor greens as mentioned in step 6c) all of the greens from all of the containers into one sample. Adjust the total weight of the leafy greens to equal one of the following sample sizes:

See 120-A-7, Supplement 1, 75 grams/25 plan = 3 gram increments

108 g (3.8 oz) 36x3	234 g (8.3 oz) 78x3	378 g (13.3 oz) 126x3	450 g (15.9 oz) 150x3
507 g (17.9 oz) 169x3	522 g (18.4 oz) 174x3	819 g (28.9 oz) 273x3	900 g (31.7 oz) 300x3
975 g (34.4 oz) 325x3	1131 g (39.9 oz) 377x3	1575 g (55.6 oz) 525x3	1800 g (63.5 oz) 600x3
1950 g (68.8 oz) 650x3	2175 g (76.7 oz) 725x3	The acceptance numbers for 819 grams of product are found in 120-A-7 under column "273" for example.	

8. Remove all obvious pieces of extraneous vegetable material (EVM) from the sample. Use the definitions in the standards to group the EVM into "I," "II" and "III". Determine the aggregate length of the EVM in each group. Record the number of 1.3 cm increments of EVM (to the nearest 1.3 cm) for each group in the classified defects section of the tally sheet.

For example:

The number of defects should be determined as follows:

$$3 \text{ cm (aggregate length)} \div 1.3 \text{ cm} = 2.3 = 2 \text{ defects.}$$

$$1 \text{ cm (aggregate length)} \div 1.3 \text{ cm} = 0.77 = 1 \text{ defect.}$$

9. Evaluate the sample for blemished areas. With the product spread evenly over the bottoms of the trays, count the number of dark specks. Each two (2) specks is equal to one blemished. Divide the total number of specks by two (2) to determine the number of blemished. Record the number of blemished in the prerequisites section of the tally sheet.

SUGGESTED ORDER FOR LOT GRADING OF A SAMPLE

PUREED STYLE (continuation).

9. Blemished (continuation).

Assign the letter grade (A, B, or SSTD) for blemished based on the tolerance shown below

Lot Tolerance for Blemished
(number of blemished)

Sample size (grams)	A	B	Sample size (grams)	A	B
108	12	21	900	73	138
234	22	40	975	78	149
378	33	62	1131	90	171
450	39	73	1575	122	234
507	43	81	1800	138	266
522	44	83	1950	149	287
819	67	126	2175	165	318

10. Cook a portion of the sample, according to Branch instructions for cooking frozen vegetables, to evaluate flavor and odor. NOTE: Cook separately any "suspect" off-odor greens retained in step 6 c of this procedure. If the "suspect" greens have a normal flavor and odor after cooking, they should be assigned grade "A" for "flavor and odor". Assign the letter grade (A or SSTD) for the sample (not each container) for "flavor and odor" in the "prerequisites" section of the tally sheet.
11. Compare the total number of defects that you found in the sample (not each container) with the acceptance number for the applicable AQL and sample size in File Code 120-A-7, Supplement I.
12. Assign a grade to the sample based on the procedure outlined in File Code 120-A-7, Lot Single Sampling Plan.



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