# Screening Virginia-Type Farmers' Stock Peanuts Before Storage[1]

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ABSTRACT

A 750-kg sample considered to be representative of Virginia-type peanuts marketed in North Carolina during the fall of 1979, was separated into 7 size categories by passing it over counter-rotating, parallel rollers spaced 12.70, 11.11, 9.52, 7.94, 6.35 and 4.76 mm apart. The material in each size category was then separated into pods, shelled kernels (LSK) and 6 different types of foreign material (FM). The LSK and peanuts shelled from the pods were graded according to U.S. Grade Standards. The data indicate that the 9.52-mm (3/8-inch) roller spacing effectively separated the pods from most of the LSK and troublesome FM such as small stones, dirt clods, pieces of glass, corn kernels and soybeans. However, the benefits and costs of separately storing and processing the mixture of LSK and FM will have to be evaluated by the individual sheller.

Key Words: Virginia-type, peanuts, foreign material, FM, losse-shelled kernels, LSK, screening, cleaning, farmers' stock.

When farmers' stock peanuts are marketed from the farm they usually contain foreign material (dirt, stems, stones, dirt clods, etc.) and shelled kernels (LSK). The 1982 crop of virginia-type peanuts produced in the United States contained 3.73% foreign material (FM) and 3.69% LSK (8).

Removal of FM and LSK from farmers' stock peanuts before storage would be beneficial to the owner of the peanuts during subsequent handling, storage and milling operations (2). There would be less mass to store and less dust during handling and shelling operations. More effective insect control would be possible because LSK probably encourage insect infestation and FM probably reduces the effectiveness of insecticide applications (6). Better aeration of the stored peanuts would take place because FM and LSK interfere with air flow through peanuts. Aeration cools the peanuts and reduces problems with quality deterioration, insect infestation, and aflatoxin production during storage (5).

Peanut kernels that are damaged by mold or insects or become contaminated with aflatoxin before harvest are often in damaged pods and consequently are more easily shelled by harvesting operations than kernels in sound pods (4). Also, LSK produced by harvesting operations are more likely to be mechanically damaged and to become discolored or dirty than are LSK produced after the peanuts are dried. Pre-storage removal of these poor quality LSK would prevent them from becoming mixed with better quality LSK produced by subsequent handling operations. Because LSK are more readily attacked by insects and are more subject to other forms of quality deterioration than are kernels in the shell, removal and processing of LSK before storage would help prevent these losses (7).

Manufacturers of peanut products are extremely concerned about the presence of FM in shelled peanuts. Some peices of FM such as small stones, dirt clods, pieces of glass, soybeans, and corn kernels have about the same size and density as peanut kernels; so they are difficult to remove and continue to be found in shelled peanuts despite efforts by shellers to remove them. Precleaning of farmers' stock peanuts prior to storage would be an important additional step toward prevention of FM in shelled peanuts.

With present grading and pricing procedures for farmers' stock peanuts, it is not economically feasible for the farmer to preclean farmers' stock peanuts before marketing (1). Probably because of the investment required for conventional cleaning equipment with enough capacity to clean the peanuts as they are marketed, most handlers do not use precleaning to remove FM and LSK from the peanuts they store. Some handlers employ more economical screening devices and/or air flow to remove dirt and other fine FM from peanuts going into storage.

The purpose of this study was to collect data that will help determine the feasibility of using screening devices with openings large enough to remove most of the FM and LSK from virginia-type peanuts before they are stored.

## Materials and Methods

Two-kg samples were collected from approximately 375 lots of virginia-type farmers' stock peanuts marketed at Severn, Aulander and Ahoskie, North Carolina during the 1979 marketing season. All of the samples were combined and the material in the 750-kg composite sample was separated into 7 size categories by passing it over counter-rotating, parallel rollers spaced 12.70, 11.11, 9.52, 7.94, 6.35 and 4.76 mm apart. The 7 categories consisted of material that passed over and/or passed through the following roller spacings: over 12.70 mm, through 12.70 mm and over 11.11 mm, through 11.11 mm and over 9.52 mm, through 9.52 mm and over 7.94 mm, through 7.94 mm and over 6.35 mm, through 6.35 mm and over 4.76 mm, and through 4.76 mm.

The material in each size category was then separated into FM, LSK and pods. (Very immature and wrinkled pods, which contained no kernels, were included in the FM and will be referred to as undeveloped fruits.) The FM was subdivided into the following 6 classifications: sticks, pieces of corn cob and similar plant materials; stones, clods of dirt and pieces of glass; peanut hulls, leaves, stems and similar trash; fine trash and dirt; corn, soybeans and other seed of similar size; and undeveloped fruits (sometimes called "twisters" or "raisins"). The LSK were separated into split and whole kernels. The split kernels were screened over 2 official grade screens with round openings 7.94 mm (20/64 inch) or 6.75 mm (17/64 inch) in diameter. The whole kernels were screened over 3 official grade screens with oblong openings 7.94 mm (20/64 inch), 7.14 mm (18/64 inch), or 5.95 mm (15/64 inch) wide. Openings in all 3 screens were 25.4 mm (1 inch) long.

Five-kg samples of pods from each size category were shelled with a sample sheller like the one used for peanut grading (3). If there was less than 5-kg of pods in a size category, all of the pods in that category were shelled. The shelled kernels were separated into split and whole kernels and these kernels were screened over the same official grade screens that were used for the LSK.

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The portions of LSK and the portions of shelled kernels retained by each of the official grade screens were each graded by the North Carolina Federal Inspection Service. The amount of damage and the amount of minor defects for each portion were determined.

## Results and Discussion

The weights of the various components of the 750-kg sample were factored to determine the corresponding weights for a 2000-kg lot. The weight of the various portions of the 2000-kg lot that would have passed over each of the roller spacings used in the study are given in Table 1. The weights of these portions were obtained by summing the weights of the portions that passed over the designated roller spacing and all of the wider roller spacings used in the study. For example, the weight of hulls and trash that passed over the 9.52 mm spacing is the sum of the weights of hulls and trash that passed over the 12.70 mm, the 11.11 mm and the 9.52 mm spacings. The 750-kg sample used in the study contained 4.95% LSK (100 x 99.04 ÷ 2000.01), and 4.77% FM (100 x (5.21 + 7.07 + 50.28 + 26.50 + 0.31 + 6.06) ÷ 2000.01).

The percentage by weight of the total lot and of each lot component that would have passed over each of the roller spacings used in the study are given in Table 2. Ninety-six percent of the pods passed over the 11.11 mm roller spacing. Unfortunately, 9% of the stones, clods and glass also passed over the 11.11 mm spacing; but most of these large pieces of FM can be removed by precleaning equipment before the peanuts are shelled. If they are not removed before the shelling operation, the material may be broken into smaller pieces that are more difficult to remove from the shelled kernels. Most of the sticks, corn cobs, hulls, and trash can usually be removed by precleaning. Nearly all of the pods (99%) passed over the 9.52 mm spacing; but 20% of the troublesome foreign material (stones, dirt clods and glass) and 4% of the LSK also passed over this spacing. Undeveloped fruits, which often cause problems in milling; and the corn, soybeans and other seed passed through the 9.52 mm opening.

The weight of the pods from a 2000-kg lot that would have passed over or passed through some of the roller spacings used in this study and the size distribution and quality of the kernels shelled from those pods are given in Table 3. (In order to conserve space, data for the 12.70 mm and the 4.76 mm spacings are not shown.) The weight of LSK from a 2000-kg lot that would have passed over or passed through some of the roller spacings used in this study and the size distribution and quality of those kernels is given in Table 4. (No LSK passed over the 12.70 mm and the 11.11 mm roller spacings). A partial description of the U.S. Standard Grades for shelled U.S. virginia-type peanuts is given in Table 5 (9).

A comparison of the tolerances for damaged or unshelled kernels for the various U.S. Grades (Table 5) with the percentages of damaged kernels in peanuts retained by the corresponding grade screens (Table 3) shows that all of the peanuts were within this tolerance. (Some of the peanuts might have exceeded this tolerance if unshelled peanuts had been present.) The tolerance for damaged kernels plus minor defects was exceeded for peanuts that were retained by several of the grade screens. Some sorting would be necessary before these peanuts would qualify for U.S. Grades.

As shown in Table 4, all of the LSK retained by the various grading screens greatly exceeded the tolerance

**Table 1. The weight of the portion of a 2000-kg lot and of each lot component that would have passed over the designated roller spacing[1].**

| | Roller Spacing | | | | | | |
|---|---|---|---|---|---|---|---|
| | 12.70 mm (1/2 inch) | 11.11 mm (7/16 inch) | 9.52 mm (3/8 inch) | 7.94 mm (5/16 inch) | 6.35 mm (1/4 inch) | 4.76 mm (3/16 inch) | Total |
| Total Lot | 1341.84 | 1743.60 | 1814.00 | 1816.64 | 1900.50 | 1936.47 | 2000.01 |
| Sticks, corn cobs, etc. | 0.00 | 0.92 | 1.32 | 2.25 | 3.16 | 3.98 | 5.21 |
| Stones, clods, glass | 0.00 | 0.66 | 1.44 | 2.84 | 4.40 | 5.90 | 7.07 |
| Hulls, trash | 10.04 | 15.66 | 18.10 | 23.28 | 31.28 | 38.82 | 50.28 |
| Fine trash, dirt | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 26.50 |
| Corn, soybeans, etc. | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.11 | 0.31 |
| Immature pods | 0.00 | 0.00 | 0.00 | 1.23 | 4.93 | 5.55 | 6.06 |
| Shelled kernels (LSK) | 0.0 | 0.0 | 3.76 | 26.82 | 51.16 | 76.56 | 99.04 |
| Mature pods | 1331.80 | 1726.36 | 1789.34 | 1805.21 | 1805.54 | 1805.54 | 1805.54 |

[1] The units of weight, if used consistently, may be either kilograms or pounds.

**Table 2. The percentage by weight of the total lot and of each lot component that would have passed over the designated roller spacings.**

| Component | Roller Spacing | | | | | |
|---|---|---|---|---|---|---|
| | 12.70 mm (1/2 inch) | 11.11 mm (7/16 inch) | 9.52 mm (3/8 inch) | 7.94 mm (5/16 inch) | 6.35 mm (1/4 inch) | 4.76 mm (3/16 inch) |
| Total Lot | 67 | 87 | 91 | 93 | 95 | 97 |
| Sticks, corn cobs, etc. | 0 | 18 | 25 | 43 | 61 | 76 |
| Stones, clods, glass | 0 | 9 | 20 | 40 | 62 | 83 |
| Hulls, trash | 13 | 20 | 24 | 30 | 41 | 77 |
| Fine trash, dirt | 0 | 0 | 0 | 0 | 0 | 0 |
| Corn, soybeans, other seed | 0 | 0 | 0 | 0 | 6 | 35 |
| Immature pods | 0 | 0 | 0 | 20 | 81 | 92 |
| Shelled kernels (LSK) | 0 | 0 | 4 | 27 | 52 | 77 |
| Mature pods | 74 | 96 | 99 | 100 | 100 | 100 |

**Table 3. The weight of pods from a 2000-kg lot that would have passed over or passed through the designated roller spacings and the size distribution and quality of the kernels shelled from those pods[1].**

| | Roller Spacing | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | 11.11 mm (7/16 inch) | | 9.52 mm (3/8 inch) | | 7.94 mm (5/16 inch) | | 6.35 mm (1/4 inch) | | |
| | over | through | over | through | over | through | over | through | |
| Cleaned pods | 1726.36 | 79.18 | 1789.34 | 16.20 | 1805.21 | 0.33 | 1805.54 | 0 | 1805.54 |
| Splits over 7.94-mm (20/64-inch) round openings | 118.91 | 1.46 | 120.37 | 0 | 120.37 | 0 | 120.37 | 0 | 120.37 |
| % damage | .77 | .68 | .77 | - | .77 | - | .77 | - | .77 |
| % minor defects | .96 | 1.36 | .96 | - | .96 | - | .96 | - | .96 |
| % dam. & minor def. | 1.73 | 2.04 | 1.73 | - | 1.73 | - | 1.73 | - | 1.73 |
| Splits over 6.75-mm (17/64-inch) round openings | 7.28 | 1.42 | 8.50 | .20 | 8.70 | 0 | 8.70 | 0 | 8.70 |
| % damage | 4.81 | .70 | 4.23 | 0 | 4.14 | - | 4.14 | - | 4.14 |
| % minor defects | 3.30 | 2.11 | 3.06 | 5.00 | 3.10 | - | 3.10 | - | 3.10 |
| % dam. & minor def. | 8.11 | 2.81 | 7.29 | 5.00 | 7.24 | - | 7.24 | - | 7.24 |
| Kernels over 5.95x25.40-mm (15/64x1-inch) openings | 133.54 | 12.04 | 144.23 | 1.35 | 145.58 | 0 | 145.58 | 0 | 145.58 |
| Count/.454 kg (count/lb) | 1019 | 1390 | 1044 | 1599 | 1049 | - | 1049 | - | 1049 |
| % damage | 1.23 | .83 | 1.20 | .74 | 1.19 | - | 1.19 | - | 1.19 |
| % minor defects | 2.67 | 6.89 | 2.95 | 10.37 | 3.02 | - | 3.02 | - | 3.02 |
| % dam. & minor def. | 3.90 | 7.72 | 4.15 | 11.11 | 4.21 | - | 4.21 | - | 4.21 |
| Kernels over 7.74x25.40-mm (18/64x1-inch) openings | 184.00 | 6.11 | 190.11 | 0 | 190.11 | 0 | 190.11 | 0 | 190.11 |
| Count/.454 kg (count/lb) | 722 | 999 | 730 | - | 730 | - | 730 | - | 730 |
| % damage | .72 | .50 | .72 | - | .72 | - | .72 | - | .72 |
| % minor defects | 1.60 | 2.62 | 1.64 | - | 1.64 | - | 1.64 | - | 1.62 |
| % dam. & minor def. | 2.32 | 3.12 | 2.36 | - | 2.36 | - | 2.36 | - | 2.36 |
| Kernels over 7.94x25.40-mm (20/64x1-inch) openings | 660.62 | 1.79 | 662.41 | 0 | 662.41 | 0 | 662.41 | 0 | 662.41 |
| Count/.454 kg (count/lb) | 521 | 852 | 522 | - | 522 | - | 522 | - | 522 |
| % damage | .31 | .56 | .39 | - | .39 | - | .39 | - | .39 |
| % minor defects | .51 | 1.68 | .66 | - | .66 | - | .66 | - | .66 |
| % dam. & minor def. | .82 | 2.24 | 1.05 | - | 1.05 | - | 1.05 | - | 1.05 |
| Kernels through 15/64 | 73.46 | 18.82 | 87.69 | 4.59 | 92.19 | .09 | 92.28 | 0 | 92.28 |
| Total kernel Wt. | 1177.81 | 41.64 | 1213.31 | 6.14 | 1219.36 | .09 | 1219.45 | 0 | 1219.45 |
| % kernels | 68.22 | 52.59 | 67.81 | 37.90 | 67.55 | 27.27 | 67.54 | - | 67.54 |

1/ The units of weight, if used consistently, may be either kilograms or pounds.

**Table 4. The weight of LSK from a 2000-kg lot that would have passed over or passed through the designated roller spacings and the size distribution and quality of those kernels[1].**

| | Roller Spacing | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 9.52 mm (3/8 inch) | | 7.94 mm (5/15 inch) | | 6.35 mm (1/4 inch) | | 4.76 mm (3/16 inch) | | |
| | Over | Through | Over | Through | Over | Through | Over | Through | Total |
| Shelled Kernels (LSK) | 3.76 | 94.17 | 26.83 | 71.10 | 56.16 | 46.77 | 76.56 | 21.39 | 97.95 |
| Splits over 7.94-mm (20/64-inch) round openings | 0 | 28.95 | 0.83 | 28.12 | 4.14 | 24.81 | 19.17 | 9.78 | 28.95 |
| % damage | - | 18.51 | 19.28 | 18.49 | 16.91 | 18.78 | 19.25 | 17.07 | 18.51 |
| % minor defects | - | 25.70 | 19.28 | 25.89 | 21.50 | 26.40 | 25.93 | 25.25 | 25.70 |
| % dam. & minor def. | - | 44.21 | 38.56 | 44.38 | 38.41 | 45.18 | 45.18 | 42.32 | 44.21 |
| Splits over 6.75-mm (17/64-inch) round openings | 0 | 6.27 | 0.05 | 6.22 | 0.39 | 5.88 | 1.60 | 4.67 | 6.27 |
| % damage | - | 28.07 | 20.00 | 28.14 | 25.64 | 28.23 | 26.87 | 28.48 | 28.07 |
| % minor defects | - | 20.89 | 40.00 | 20.74 | 17.96 | 21.09 | 20.00 | 21.20 | 20.89 |
| % dam. & minor def. | - | 48.96 | 60.00 | 48.88 | 43.59 | 49.32 | 46.87 | 49.68 | 48.96 |
| Kernels over 5.95x25.40-mm (15/64x1-inch) openings | 0 | 11.17 | 0.69 | 10.48 | 8.59 | 2.58 | 11.17 | 0 | 11.17 |
| Count/.454 kg (count/lb) | - | 1074 | 1061 | 1075 | 1022 | 1248 | 1074 | - | 1074 |
| % damage | - | 6.72 | 7.25 | 6.58 | 6.17 | 8.53 | 6.62 | - | 6.72 |
| % minor defects | - | 7.52 | 8.70 | 7.44 | 7.10 | 8.91 | 7.52 | - | 7.52 |
| % dam. & minor def. | - | 14.24 | 15.95 | 14.02 | 13.27 | 17.44 | 14.14 | - | 14.24 |
| Kernels over 7.14x25.40-mm (18/64x1-inch) openings | 0 | 13.53 | 1.50 | 12.03 | 13.53 | 0 | 13.53 | 0 | 13.53 |
| Count/.454 kg (count/lb) | - | 718 | 716 | 718 | 718 | - | 718 | - | 718 |
| % damage | - | 5.03 | 5.33 | 4.82 | 5.30 | - | 5.03 | - | 5.03 |
| % minor defects | - | 6.06 | 5.33 | 6.15 | 6.06 | - | 6.06 | - | 6.06 |
| % dam. & minor def. | - | 11.09 | 10.66 | 10.97 | 11.09 | - | 11.09 | - | 11.09 |
| Kernels over 7.94x25.40-mm (20/64x1-inch) openings | 3.76 | 19.75 | 23.51 | 0 | 23.51 | 0 | 23.51 | 0 | 23.51 |
| Count/.454 kg (count/lb) | 440 | 541 | 525 | - | 525 | - | 525 | - | 525 |
| % damage | 5.32 | 5.92 | 5.87 | - | 5.87 | - | 5.87 | - | 5.87 |
| % minor defects | 4.26 | 4.61 | 4.55 | - | 4.55 | - | 4.55 | - | 4.55 |
| % dam. & minor def. | 9.58 | 10.53 | 10.42 | - | 10.42 | - | 10.42 | - | 10.42 |
| Other kernels | 0 | 14.5 | .25 | 14.25 | 1.00 | 13.50 | 7.57 | 6.93 | 14.50 |

1/ The units of weight, if used consistently, may be either kilograms or pounds.

Table 5. A partial description of U.S. Standard Grades for shelled U.S. virginia-type peanuts.

| | U.S. Grade | | | | |
|---|---|---|---|---|---|
| | Extra Large | Medium | No. 1 | No. 2 | Splits |
| Dimensions of screen opening the kernels must pass over (mm) | 7.94x25.40 | 7.14x25.40 | 5.95x25.40 | 6.75 round | 7.94 round |
| (inches) | 20/64x1 | 18/64x1 | 15/64x1 | 17/64 round | 20/64 round |
| Tolerances (% of sample weight) | | | | | |
| Damaged or unshelled kernels[a] | 1 | 1.25 | 1.25 | - | - |
| Damaged or unshelled kernels plus minor defects[b] | 1.75 | 2 | 2 | 2.5 | 2 |

[a]"Unshelled" means a peanut kernel with part or all of the hull (shell) attached. "Damage" means that the peanut kernel is affected by one or more of the following: (1) rancidity or decay; (2) mold; (3) insects, worm cuts, web, or frass; (4) freezing injury causing hard, translucent or discolored flesh; and (5) dirt when the surface of the kernel is heavily smeared, thickly flecked, or coated with dirt, seriously affecting its appearance.

[b]"Minor defects" means that the peanut kernel is not damaged but is affected by one or more of the following: (1) Skin discoloration which is dark brown, dark gray, dark blue, or black and covers more than one fourth of the surface; (2) flesh discoloration which is darker than a light yellow color or consists of more than a slight yellow pitting of the flesh; (3) sprout extending more than one eighth of an inch from the tip of the kernel; and (4) dirt when the surface of the kernel is distinctly dirty, and its appearance is materially affected.

of the corresponding U.S. Grades both for damaged kernels and for damaged kernels plus minor defects. Irregardless of the screen size or roller spacing, the splits contained extremely high percentages of damaged kernels plus kernels with minor defects with a range of 38.41% to 48.96%. All of the whole kernels retained by the 5.95 mm, the 7.14 mm and the 7.94 mm screens contained 14.24%, 11.09% and 10.42% damaged kernels plus kernels with minor defects, respectively. The value of the LSK for edible purposes would depend upon the following factors: (a) the relative market price of edible and oil-stock peanuts; (b) the cost of various cleanup operations such as electric-eye sorting, hand sorting or blanching; (c) the amount of product lost during the cleanup process; and (d) the aflatoxin concentration of the LSK.

Determination of the feasibility of screening farmers' stock peanuts before storage and the selection of the screen opening to use is a complex problem. For example, if a screen opening of 9.52 mm (3/8 inch) were used, 9% of the toal weight including 96% of the LSK, 1% of the mature pods and most of the troublesome FM would pass through the screen (Table 2). The benefits and costs of storing and processing this material separately would have to be considered by each individual sheller. Prompt processing of the poor quality material would probably reduce further deterioration of the LSK and reduce storage costs. As shown in Table 3, 16.20 kg of small pods from a 2000-kg lot of farmers' stock peanuts would pass through the 9.52 mm roller spacing. These pods would yield 0.20 kg of split kernels that would be retained by the U.S. No. 2 grade screen and 1.35 kg of kernels that would be retained by the U.S. No. 1 grade screen, but 5% and 11%, respectively, of the kernels would have damage and/or minor defects. These small pods would also yield 4.59 kg of kernels that would pass through the U.S. No. 1 grade screen.

Consideration of the data presented in this report may encourage some peanut shellers to attempt to reduce storage losses, reduce operating costs, improve the quality of their product and reduce the risk of aflatoxin contamination in their product by screening their farmers' stock peanuts to remove LSK and FM before storage.

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