A Triple Deck, Parallel Belt Screen for Farmer Stock Peanuts[1]

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ABSTRACT

Belt screens currently used in the peanut industry separate farmer stock peanut materials into two size categories based on diameter. Utilizing belt screens for obtaining more than two size categories requires two or more screens with different spacings between belts for each screen. A modification of the belt screen design was developed incorporating three screen decks into a single machine. The three decks provide the ability to separate small foreign materials, large vegetative foreign materials, and loose shelled kernels and small pods from farmer stock peanuts. The machine was equipped with fixed spacings appropriate for screening farmer stock peanuts (cv. Florunner) for performance testing. Round belts (1.27 cm dia.) for the three decks were spaced on sheaves to provide 0.64-, 1.03-, and 2.54-cm openings between belts. Screen capacity and separation performance were evaluated by varying material feed rates and belt speeds. Belt speeds evaluated were 105.2, 117.3, 130.0, 140.7, and 152.4 cm/sec and feed rates varying from 5170 to 27,210 kg/hr. An average of 91.55% of the sample weights was divided into the 10.3-mm < diam. < 25.4-mm separation. Compared to prescreening sample composition, the average LSK percentage was reduced by 6.39% and FM by 7.36% in the 10.3-mm < diam. < 25.4-mm separation. Within the ranges tested, derived equations indicated that feed rate and belt speed had limited effects on separations. The openings between the belts appeared to influence material separation more than feed rate and belt speed.

Key Words: *Arachis hypogaea* L., cleaning, foreign material, loose shelled kernels, LSK, screening, separation.

At the farmer stock (FS) level, a major consideration of peanut quality and value is the composition of varying proportions of peanut pods, loose shelled kernels (LSK), and foreign materials (FM). LSK are kernels inadvertently shelled from pods during harvesting or post harvest processing. The value of LSK to farmers is only about 20% of in-shell peanuts (6, 7). Because of the low FS price, processing of LSK is generally financially advantageous to the sheller if the sheller has the capability to process and market LSK as edible kernels. However, manufacturer acceptance of utilizing LSK in food grades of shelled peanuts is diminishing because of the general low quality and aflatoxin risk often associated with this type of peanut kernel (1, 4, 6). FM are materials other than pods or LSK gathered during harvesting or collected during subsequent processing. Processors and manufacturers of peanut products monitor the quality of incoming peanuts from shellers for types and amounts of FM. Stringent quality stipulations for peanuts from shellers are generated from this type of quality tracking. Development of LSK and FM removal technology continues to be very important to the U.S. peanut industry.

Removal of LSK and FM from peanuts is attempted during harvesting, shelling, and manufacturing with various processes including screening (1, 5). Mechanical screening separates materials into different size categories by allowing smaller particles to fall through a separation area (deck) and larger materials to flow above and across the deck. Historically, vibrating screens have been used to make this type of separation in peanuts. Recently, three additional types of screens have been developed for peanut screening—the belt screen (2), the diverging belt screen (3), and a multi-deck orbital screen (Carter Manufacturing Company, Ariton, AL). The com-

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mercially marketed belt screen is a single deck separator that divides the materials into only two size categories. The recently developed, diverging belt screen is a single deck belt screen which can make multiple diameter separations, but is not currently being marketed. The multi-deck orbital screen separates materials into three to five size categories based on screen sizes used in its deck configuration.

Recently, an additional type of belt screen was designed and developed by the United States Department of Agriculture (USDA), Agricultural Research Service (ARS), South Atlantic Area (SAA), National Peanut Research Laboratory (NPRL), Dawson, GA., and the Lewis M. Carter Manufacturing Co., Donalsonville, GA through a USDA Cooperative Research and Development Agreement. This screen utilizes three decks of multiple, parallel belts spaced at specific distances and rotating continuously on properly positioned sheaves to provide a self-cleaning separator for screening.

The purpose of this research was to design and evaluate a multiple deck, parallel belt screen with capability to separate FS peanut materials into four sizes of materials. This type of screen could provide the industry with additional capabilities for peanut quality maintenance during subsequent processing.

Materials and Methods

A schematic of the triple deck, parallel belt screen is shown in Fig. 1. The screen divides FS peanuts into four sizes or diameters of materials including diam. < 6.4 mm, 6.4 mm < diam. < 10.3 mm, 10.3 mm < diam. < 25.4 mm and diam. > 25.4 mm (Fig. 1) similar to those shown in Fig. 2. During screen operation, all belts rotate in the same direction moving the FS peanut material in the same horizontal direction (Fig. 1). Materials with diameters less than the openings (gaps) between belts fall through the decks. Screen deck belts are commercially available, 1.27-cm diam. round belts. Belts are spaced at specific distances with 10.16-cm diam. sheaves with appropriately milled V-grooves. The first or input deck is 68.89 cm long and 120.65-cm wide with 0.64-cm gaps between belts. At the discharge sheave of this deck, alternating belts continue horizontally toward a second discharge sheave forming the second deck with 2.54-cm gaps between belts. The second deck is 167.64 cm long and 120.65 cm wide. The third deck, positioned underneath the second deck, is 97.47 cm long and 122.24 cm wide with 1.03 cm belt gaps. The input for the third deck begins directly below the discharge of the input deck. Separate side

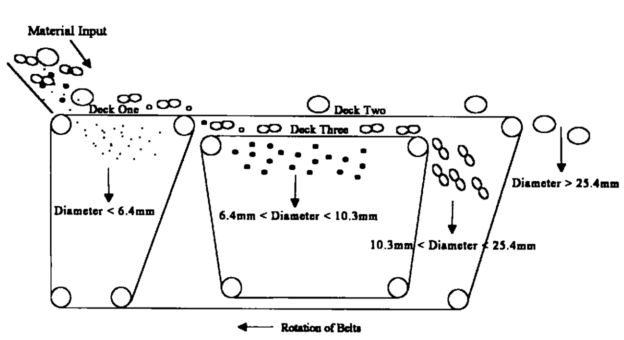

Fig. 1. Schematic of the triple deck, parallel belt screen.

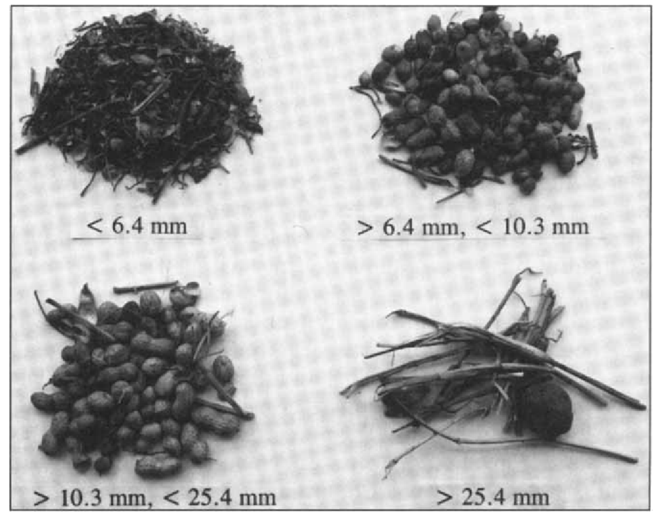

Fig. 2. Typical separations from the triple deck, parallel belt screen deck gaps.

discharge chutes are provided for material falling through the input deck, material riding over deck three, and material falling through deck three. An in-line discharge chute is provided for material riding over deck two at the end of the machine.

The performance of the screen in separating FS peanuts (cv. Florunner) was evaluated at a Birdsong Peanuts buying point in Dawson, GA during 1995 and 1996. The effects of two independent variables, namely belt speed (Bspd) and material feed rate (MatFR), on screen operation were examined in three experiments. The independent variables and corresponding settings planned for the first experiment included five Bspd's of 105.2, 117.3, 130.0, 140.7, and 152.4 cm/sec and the five MatFR's of 5170, 7260, 9430, 11,520, and 13,520 kg/hr. Bspd's for experiments two and three were the same as experiment one; however, MatFR's were increased for experiments two and three because data from the preceeding experiment did not indicate that the capacity of the machine had been reached. Planned MatFR's for the second experiment were increased to 8980, 11,240, 15,960, 16,830, and 18,140 kg/hr. MatFR's for the third experiment were increased to 9070, 13,610, 18,140, 22,680, and 27,210 kg/hr. All combinations of Bspd's and MatFR's were tested in random order during each experiment.

After harvest and a 2-mo minimum storage period, approximately 11,000 kg of FS peanuts, including LSK and FM, were screened during each experiment. All peanuts for each experiment were placed in a 90,700-kg hopper bottom holding bin prior to running the tests of an experiment. Peanuts were supplied to the screen from an adjustable belt feeder which had been calibrated prior to each experiment to provide the approximate MatFR. Samples (approx. 450 kg) were screened for each combination of Bspd and MatFR.

The first step in screening a sample was to set the screen and belt feeder operational parameters. Next, screen belt rotation was started. Then, the belt feeder was activated and operated until the sample volume (approx. 450 kg) was reached. Materials falling through decks one and three along with materials riding over decks two and three were collected with four individual containers as subsamples. The four subsamples were weighed and sampled for composition analysis. Greater than 90% of each sample would exit the machine as the subsample riding deck three. Two belt conveyors transported the subsample riding deck three to a 4.3 × 2.4 × 1.5-m drying trailer used as the collection container. Approximately 20 kg of the subsample riding deck three was extracted with a pneumatic cross-cut sampler which periodically interrupted the flow of materials moving to the drying trailer. The other three subsamples were extracted utilizing a FS divider used in conventional FS grading during farmer marketing. After all samples of an experiment were screened, collected subsamples were manually separated into peanut pods, LSK, and FM, and weighed. The FM were further separated into the following categories: sticks, rocks, dirt, and miscellaneous materials (Mis_FM). Weight percentage of each fraction was calculated for further analysis. The percentages of the subsamples separated from each sample were calculated using the sum of subsample weights as the initial sample weight.

Results and Discussion

A comparison of the average compositions of the samples screened during the three experiments examining the performance of the triple deck, parallel belt screen is shown in Table 1. The portion of Table 1 above the dotted line combines all components of FM as a singular component whereas below the line the components of FM are detailed. The average percentage of pods in samples of experiments 1, 2, and 3 were not significantly different ($P \leq 0.05$) (Table 1). Average LSK's in samples from all experiments were significantly different ($P \leq 0.05$) with a range of average differences varying about 4%. The average percentage of FM in samples of experiment three averaged significantly higher ($P \leq 0.05$) than the average percentage of FM in samples of experiment one (2.29% higher). The average percentage of FM in samples of experiment one was not significantly different ($P \leq 0.05$) from the average percentage of FM in samples of experiment two. Similarly, the average percentage of FM in samples of experiment two was not significantly different ($P \leq 0.05$) than the average percentage of FM in samples of experiment three. Some of the averages (lower portion of Table 1) of the four components of FM for the three experiments also were significantly different ($P \leq 0.05$). Sticks in samples of experiment one were significantly fewer ($P \leq 0.05$) than sticks in samples of experiment two (0.75% fewer) and three (1.07% fewer). Mis_FM for experiments one and three were significantly less ($P \leq 0.05$) than Mis_FM in experiment two. Dirt and rocks in the samples of the three experiments were not significantly different ($P \leq 0.05$). Even though significant differences in average percentages of LSK and some components of FM in the samples of the experiments existed, all data collected during screening were combined for an analysis of performance for the screen. Analyses of the three data sets individually indicated the same general trends in performance. Additionally, the major components of the farmer stock materials (pods) were not significantly different. The variability of composition between experiments of components other than pods is an indication of the variability expected in normal FS peanut screening.

The average composition of samples of the three experiments combined is presented in Table 2. Average LSK's for the experimental samples ranged from 2.3 to 3.6% higher than the yearly (1985-1995) average grade factors for LSK for runner-type peanuts (9). FM samples averaged 4.7 to 5.3% higher (9). The higher averages in LSK and FM indicate that the peanuts used in the tests reported herein were less than average quality FS peanuts at farmer marketing. Screen performance evalua-

Table 1. Comparison of the average sample compositions of farmer stock peanuts used in the three experiments evaluating performance of the triple deck, parallel belt screen.

Material	Expt.	Mean[a]	Minimum	Maximum	S.D.
		%			
Pods	1	83.14 a	76.55	89.73	3.26
	2	83.24 a	73.96	91.47	4.37
	3	84.85 a	77.18	94.93	5.09
Loose shelled kernels	1	8.94 a	4.02	14.40	2.56
	2	7.59 b	2.72	14.55	3.05
	3	4.95 c	2.04	7.63	1.56
Foreign material	1	7.92 b	4.77	11.98	2.39
	2	9.17 ab	5.81	13.61	2.03
	3	10.21 a	3.18	16.24	3.61
Foreign material components:					
Sticks	1	2.37 a	1.28	4.58	1.00
	2	1.63 b	1.08	2.26	0.35
	3	1.30 b	0.53	3.09	0.72
Dirt	1	0.46 c	0.19	0.69	0.16
	2	1.60 b	0.38	5.37	1.22
	3	2.82 a	0.88	5.99	1.28
Rocks	1	1.50 b	0.94	2.62	0.49
	2	0.20 c	0.01	0.45	0.11
	3	3.03 a	1.33	5.63	1.09
Miscellaneous FM	1	3.59 b	1.77	6.10	1.45
	2	5.73 a	3.20	8.46	1.11
	3	3.39 b	1.51	5.35	1.15

[a]Means for each material in a column followed by the same letter are not significantly different ($P \leq 0.05$) according to Duncan's new multiple-range test (8).

Table 2. Average sample composition of farmer stock peanut material used during the experiment.

Material	Mean	Minimum	Maximum	S.D.
	%			
Pods	83.79	73.96	94.93	4.38
Loose shelled kernels	7.04	2.04	14.55	2.94
Foreign materials	9.17	3.18	16.24	2.91
Foreign material components				
Sticks	1.73	0.53	4.58	0.85
Dirt	1.70	0.19	5.99	1.41
Rocks	1.61	0.01	5.63	1.38
Miscellaneous FM	4.24	1.51	8.46	1.62

tions utilizing these peanuts should provide a more rigorous evaluation than would be expected in screening average quality runner-type peanuts.

Quadratic equations were derived from the data to examine the effects of the independent variables on the performance of the triple deck, parallel belt screen in separating the FS peanut materials for each of the three deck gaps of the screen. A multiple variable, quadratic regression analysis was used to generate these equations (8). The equations derived were of the following form:

$$DV = IC + (M_1 \times Bspd) + (M_2 \times Bspd^2) + (M_3 \times MatFR) + (M_4 \times MatFR^2) + (M_5 \times Bspd \times MatFR); \qquad \text{[Eq. 1]}$$

where:

DV = Dependent variable, i.e.,
% of sample weight separated,
% of pod weight separated,
% of LSK weight separated,
% of foreign material weight separated,
% of stick weight separated,
% of dirt weight separated,
% of rock weight separated,
% of miscellaneous foreign material weight separated;

IC = intercept;
M_1 = coefficient for the Bspd term;
M_2 = coefficient for the $Bspd^2$ term;
M_3 = coefficient for the MatFR term;
M_4 = coefficient for the $MatFR^2$ term;
M_5 = coefficient for the (Bspd × MatFR).

Correlation coefficients (r) of the derived equations for the separated materials are presented in Table 3 for each screen separation. Most of the correlation coefficients were less than 0.7, except for sticks in the diam. < 6.4-mm separation, the 6.4-mm < diam. < 10.3-mm separation, and the 10.3-mm < diam. < 25.4-mm separation. Estimates of intercepts and coefficients for equations derived for these stick separations and significance of independent variable terms in each equation are presented in Table 4. Equations derived for the remainder of the materials with < 0.7 are not presented even though some of the excluded equations had terms that were significant ($P \leq 0.05$) because of their limited accuracy (less than 50%) in predicting the separations made with the screen during the experiment.

Equations derived for the diam. < 6.4-mm separation and the 10.3-mm < diam. < 25.4-mm separation of sticks had only one independent variable (MatFR) which significantly affected separation ($P \leq 0.05$) (Table 4). The diam. < 6.4-mm separation of sticks varied from 2.7 to 33.4% with an average of 15.2% and a standard deviation (SD) of 8.2% (Table 5) and was significantly affected by MatFR (Table 4). Similarly, the 10.3-mm < diam. < 25.4-mm separation of sticks varied from 36.1 to 86.6% with an average of 61.3% and a SD of 12.6% (Table 5), and was significantly affected by MatFR (Table 4). The 6.4-mm < diam. < 10.3-mm separation of sticks was significantly affected by both Bspd and MatFR (Table 4). A comparison of the Type II Sums of Squares (SS) generated during the regression analysis for this separation of sticks indicated that MatFR had a much higher influence on the prediction equation than Bspd. MatFR accounted for approximately 76.4% of the total Type II SS. Bspd accounted for 23.3% and interaction between MatFR and Bspd for 0.3%.

Composition of the FS peanut material, Bspd, MarFR and deck gaps are essentially all the parameters which could effect separations made by the screen. Bspd and MatFR had limited effects on the separations made by the screen except for sticks. The major components of the FS peanut material were very similar. It is assumed, therefore, that the three deck gaps were the primary factors controlling the separations made during the experiment. The average percentages of sample weight and separation of sample components other than sticks for the four separations provided by the screen are shown in Table 5 also. An average of 91.55% of the sample weights were divided into the 10.3-mm < diam. < 25.4-mm separation with the remainder of the samples divided among the diam. < 6.4-mm separation; the 6.4-mm < diam. < 10.3-mm separation; and the diam. > 25.4-mm separation (Table 5). A comparison of the composition of the samples prior to screening and the separations made by the screen are shown in Table 6. Compared to

Table 3. Correlation coefficients for equations describing the percentage of each dependent variable separated into the four separations of the screen.

	Correlation coefficient (r)							
Screen separation	Sample wt.	Pods	LSK	FM	Sticks	Dirt	Rocks	Mis_ FM
Diam. < 6.4 mm	0.35	0.48	0.56	0.30	0.94	0.53	0.24	0.45
6.4 mm < diam. < 10.3 mm	0.47	0.37	0.59	0.39	0.87	0.35	0.22	0.28
10.3 mm < diam. < 25.4 mm	0.45	0.36	0.52	0.42	0.95	0.41	0.17	0.26
Diam. > 25.4 mm	0.63	0.69	0.20	0.55	0.39	0.17	0.41	0.30

Table 4. Coefficients for equation terms describing the percentage of stick weight separated by the screen for three separations.

	Independent variable coefficients for equation[a]					
Screen separation	IC	M1	M2	M3	M4	M5
Diam. < 6.4 mm	37.409	-0.011	0	-2.173*	0.038*	-0.001
6.4 mm < diam. < 10.3 mm	-24.941	0.354*	0.001*	0.693	-0.035*	0.001
10.3 mm < diam. < 25.4 mm	81.324	-0.346	0.001	1.799*	-0.019	0.003

*Significant at the $P \leq 0.05$ level of probability.

[a]Percentage of stick weight separated = $IC + (M_1 \times Bspd) + (M_2 \times Bspd^2) + (M_3 \times MatFR) + (M_4 \times MatFR^2) + (M_5 \times Bspd \times MatFR)$ [Eq. 1].

Table 5. Minimums, maximums, means, and standard deviations of the percent of weights of each dependent variable for each diameter separation of the screen.

Deck gap		Dependent variable separation							
		Sample	Pods	LSK	FM	Sticks	Dirt	Rocks	Mis_FM
mm		%							
< 6.4	Min	0.597	0.004	11.954	10.906	2.663	32.579	0	10.202
	Max	7.672	0.331	34.538	58.411	33.399	93.530	34.012	48.042
	Mean[a]	1.753 c	0.036 c	23.109 b	24.348 c	15.179 c	72.668 a	9.083 c	24.138 c
	SD	0.996	0.048	5.975	8.930	8.216	13.836	8.012	6.956
> 6.4, < 10.3	Min	3.365	2.014	46.523	19.486	5.430	4.706	0	23.127
	Max	11.998	7.803	72.357	47.663	27.446	60.480	51.314	68.013
	Mean	6.648 b	4.148 b	56.735 a	29.789 b	19.398 b	13.489 b	21.903 b	40.287 a
	SD	1.944	1.641	1.641	5.221	5.074	9.096	10.884	8.547
> 10.3, < 25.4	Min	82.720	92.140	10.564	17.977	36.145	1.764	34.131	12.063
	Max	95.844	97.362	39.040	65.981	86.579	60.549	100	58.017
	Mean	91.551 a	95.811 a	20.712 c	45.244 a	61.263 a	15.023 b	68.068 a	36.143 b
	SD	2.665	1.653	5.149	10.213	12.551	11.757	16.573	10.063
> 25.4	Min	0.010	0	0	0.199	1.365	0	0	0
	Max	0.206	0.027	0.010	4.496	13.023	7.041	9.380	0.065
	Mean	0.047 d	0.006 c	0.0004 d	1.206 d	4.526 d	0.571 c	1.165 d	0.015 d
	SD	0.030	0.007	0.002	0.800	2.090	1.441	1.681	0.017

[a]Means in a column followed by the same letter are not significantly different ($P \leq 0.05$) according to Duncan's new multiple-range test (8).

Table 6. Comparison of the average components of sample compositions with the components of compositions of the four separations from the screen.

Material[a]	Samples	Screen separation			
		Diam. < 6.4 mm	6.4 mm < diam. < 10.3 mm	10.3 mm < diam. < 25.4 mm	Diam. > 25.4 mm
	%	%			
Pods	83.79 b	2.49 e	57.01 c	97.54 a	10.62 d
LSK	7.04 c	42.16 a	25.79 b	0.65 d	0.05 d
FM	9.17 d	55.34 b	17.20 c	1.81 e	89.33 a
Foreign material components					
Dirt	1.70 bc	16.05 a	0.58 c	0.04 c	3.33 b
Rock	1.61 c	6.04 b	3.44 bc	0.55 c	20.41 a
Stick	1.73 c	6.76 b	2.03 c	0.43 c	65.01 a
Misc. FM	4.24 c	26.48 a	11.14 b	0.79 d	0.51 d

[a]Means in a row followed by the same letter are not significantly different ($P \leq 0.05$) according to Duncan's new multiple-range test.

the prescreening composition, the division of the samples by the screen reduced the average LSK percentage by 6.39% in the 10.3 mm < diam. < 25.4-mm separation (Table 6). Similarly, FM was reduced an average of 7.36%. The data shown in Tables 2, 5, and 6 indicate that the triple deck, parallel belt screen has the capability to separate or concentrate various components of FS peanuts. The capacity of the screen is relatively high compared to a single deck belt screen (1, 2). In some situations, the screen could be used also as a substitution for a FS peanut cleaner.

Summary and Conclusions

The triple deck, parallel belt screen can be used to separate FS peanut materials into different diameter ranges. The data presented show limited effects of the operational parameters on separations of FS peanuts. The amount of material divided into the four separations made by the screen probably depends more on deck gap than belt speed and material feed rate.

It should be noted that the material feed rate of the screen was limited by the design of the discharge of the third deck. The maximum material feed rate obtained was 27,210 kg/hr. Space limitations on the side of the screen limited the discharge opening. Influences of belt speed and material feed rate could possibly have been effected because of the flow rate limitation. Also, some difficulty was experienced during testing with peanut stems unintentionally collected at the metal scrapers serving as cleaners for the slots in the discharge sheaves of decks one and three. While collection of this material during the test runs likely had no effect on the test results, some modification in screen design would have to be made to prohibit an excessive collection on a commercially produced machine to avoid increasing horsepower requirements and possibly adversely affecting separation of FS peanuts.

Today's economics within the U.S. peanut industry prohibit disposal of any usable peanut material during any phase of production and processing. All separations made by the triple deck, parallel belt screen contained peanut material. Subsequent separation of pods, LSK, and FM is difficult and requires additional techniques such as aspiration and specific gravity separation.

Using the triple deck, parallel belt screen will improve the quality of FS peanuts, but will require scrutiny in deck gap configuration and management of machine operation for desired material separation. As with other types of belt screens, the triple deck, parallel belt screen offers a nonblanking alternative to vibratory screens for screening FS peanut materials.

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Literature Cited

1. Blankenship, P.D., C.L. Butts, J.I. Davidson, Jr., R.J. Cole, J.W. Dorner, T.H. Sanders, F.E. Dowell, F.D. Mills, Jr., and J.W. Dickens. 1988. The Peanut Quality Enhancement Project. The Nat. Peanut Found., Arlington, VA.
2. Blankenship, P.D., and J.I. Davidson, Jr. 1995. Effects of belt screen operational settings on separations of farmers stock peanut materials. Peanut Sci. 22:71-76.
3. Blankenship, P.D., and F.E. Dowell. A diverging belt screen for farmer stock peanuts. Peanut Sci. 24:37-41.
4. Cole, R.J., and J.W. Dorner. 1991. Aflatoxin management during peanut production and processing: Current and future strategies, pp. 247-256. *In* K. Mise and J. L. Richard (eds.) Emerging Food Safety Problem Resulting from Microbial Contamination. Proc. 7th Int. Symp. on Toxic Microorganisms, U.S.-Japan Conf. on the Development and Utilization of Natural Resources, Tokyo, Japan.
5. Davidson, J.I., Jr., T.B. Whitaker, and J.W. Dickens. 1982. Grading, cleaning, storage, shelling and marketing of peanuts in the United States, pp. 571-623. *In* H.E. Pattee and C.T. Young (eds.) Peanut Science and Technology. Amer. Peanut Res. Educ. Soc., Inc., Yoakum, TX.
6. Lamb, M.C., and P.D. Blankenship. 1996. The United States Peanut Industry Revitalization Project. The Nat. Peanut Counc., Arlington, VA.
7. Peanut Loan Schedule. 1997. 1996 Crop. USDA-FSA-1014, Washington, DC.
8. Statistical Analysis System, 1993. SAS Institute Inc., Cary, NC.
9. USDA, Federal-State Market News Service. 1997. Peanut Marketing Summary. 1996 Crop. Washington, DC.

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