Feasibility of Purchasing Screened Farmer Stock Peanuts: The Sheller's Perspective

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ABSTRACT

Mechanical screening to separate foreign material, loose shelled kernels (LSK), and smaller, lower value pods (thrus) from larger, higher value pods (overs) increased the value of peanut lots compared to unscreened lots. The average value of overs was $29.15 per Mg higher than unscreened peanuts. Marketing overs translates into higher purchase cost to shellers. The percentage of LSK in unscreened peanuts was a key factor in whether shellers would prefer to purchase screened lots because, as LSK of unscreened lots increases, the value per Mg of farmer stock (FS) peanuts decrease. The value of unscreened lots with 1% LSK was $12.33 per Mg less (not significant) than the resulting value of lots after screening, while the value of unscreened lots with 10% LSK was $57.57 per Mg less (P = 0.01) than the resulting value of lots after screening. LSK in screened lots were generally reduced to less than 1% limiting the availability of LSK for shellers to recover and use in edible channels. However, removal of high risk components (LSK and small kernels) should reduce aflatoxin levels in overs lots compared to unscreened lots. Significant increases in jumbo and medium outturn and decreases in No. 1 outturn were associated with shelling screened lots. Gross shelled stock value increased $32.37 per Mg for screened lots with no LSK recovery and $10.82 per Mg for unscreened lots with total LSK recovery. The differences in dollar returns from purchasing and shelling screened lots were compared to unscreened lots for different levels of LSK in unscreened lots and varying LSK recovery levels into edible channels.

Key Words: *Arachis hypogaea* L., economic feasibility, screening, shelled stock peanuts.

Mechanical screening of farmer stock (FS) peanuts prior to marketing increases the value of farmer stock (FS) peanut lots (1, 4). Screening divides peanut lots into two sublots [overs: larger, higher value pods; and thrus: smaller, lower value pods and loose shelled kernels (LSK) and foreign material (FM)] based on physical size characteristics. To remain consistent with peanut regulations, farmers must either re-introduce LSK and small peanut pods removed during the screening process back to the lot or capture, grade, and market these peanut materials separately in established channels. Because of the weight removal and the economic value of the thrus materials, farmers must market this fraction for screening to be economically feasible (4).

Comparing overs to unscreened lots, sound mature kernels and sound splits (SMKSS) increased 0.61% while LSK, FM, and other kernels (OK) were decreased by 4.31, 2.32, and 0.30%, respectively, contributing to the value increase of screened lots. The average value of peanuts was increased by $29.15 per Mg in the overs. This translates directly into higher purchase cost to peanut shellers for overs. Removal of LSK and small pods by screening should increase shelling efficiency and peanut quality. Henning *et al.* (3) reported that mechanical screening reduced aflatoxin contamination by 35% in overs lots by concentrating aflatoxin in the thrus lots. This finding parallels results from Whitaker *et al.* (6) who reported that aflatoxin in LSK accounted for 33.3% of total aflatoxin mass. Cumulatively, LSK, OK, and total damage (DAM) accounted for 93.1% of total aflatoxin but only 18.4% of the total weight of unscreened FS lots (6). When analyzing the economic feasibility of commercially shelling contaminated Seg. 1 lots (ppb = 99.9 in mediums), Lamb *et al.* (5) concluded that it is economically feasible to recover contaminated Seg. 1 lots. However, unless shelled stock prices exceeded $2.205/kg, it was not feasible to recover Seg. 3 lots (ppb = 327 in mediums) because of the added processing cost and increased removal of peanuts during re-milling and blanching (5). Blankenship *et al.* (2) concluded that, because of the low FS price ($0.15/kg), processing LSK is financially advantageous for shellers, depending on the

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ability of the sheller to reclaim and market LSK into edible peanuts. Several other studies also have addressed changes in FS grade factors and shelling outturn percentages, but the literature is void of information on the economic feasibility of purchasing and shelling screened (overs) versus unscreened peanuts. Due to the poor quality composition of the lot (mainly LSK, small pods, and foreign material), thrus are generally not purchased and shelled for marketing directly into commercial edible channels. The objective of this research was to determine the economic feasibility of shellers purchasing and shelling overs versus unscreened peanuts. Thus, in this analysis, the purchased input for shelling would consist of overs and unscreened peanut lots.

Materials and Methods

Lots (n = 394) of runner-type peanuts were gathered from five cooperating buying points in the Southeast. Samples were divided and a subsample was screened using a parallel belt screener with a 0.953-cm separation width resulting in two sublots [overs (n = 394) = materials which ride the screening device and thrus (n = 394) and materials which fall through the screening device]. Farmer stock grade data and weights for the unscreened and overs lots were obtained using standard Federal-State Inspection Service grading procedures (7). The farmer stock price per Mg for each lot was calculated based on the respective grade factors and the national average support price ($677.46/Mg). The average difference in loan value associated with purchasing overs instead of unscreened lots is:

$$FS\ diff = \sum_{i=1}^{n} (FS_{oi}-FS_{ui})n^{-1} \quad \text{[Eq. 1]}$$

where:

FS_{diff} is the average difference in loan value per Mg between overs and unscreened lots,

FS_o is the loan value per Mg of overs lots based upon grade,

FS_u is the loan value per Mg of unscreened lots based upon grade, and

n represents the number of lots (n = 394).

A key variable that affects the range of FS_{diff} is the percentage of LSK in the unscreened lots and the resulting percentage of LSK in the overs after screening. LSK are deducted from a farm's quota poundage; however, they are valued at $0.15/kg instead of $0.67/kg that is received for SMKSS. Thus, the FS lot loan value is inversely proportional to the mass of LSK. A formula accounting for the difference in input cost to shellers purchasing varying levels of LSK in unscreened lots is as:

$$FS_{lsk} = \sum_{i=1}^{n} \sum_{l=1}^{k} (FS_{oi}-FS_{ui})n_l^{-1} \quad \text{[Eq. 2]}$$

where:

FS_{lsk} is the average difference in loan value per Mg between overs and unscreened lots for integer levels of LSK in the unscreened lots (range 1 to 10%), and

k represents the number of observations within each integer level of LSK.

The commercial shelling outturns was obtained using the following screen sizes and kernel values:

Outturn	Screen Size	$/kg
Jumbos	Ride 0.833 × 1.905-cm slotted screen	$1.39
Mediums	Ride 0.714 × 1.905-cm slotted screen	$1.37
No. 1s	Ride 0.635 × 1.905-cm slotted screen	$1.32
US splits	Ride 0.675-cm round screen	$1.35
Oil stock (OS)	Fall through 0.675-cm round + damage + LSK not recovered into edible	$0.33

The average difference between unscreened and overs gross value per Mg of each shelled stock lot can be obtained from:

$$SS_{diff} = \sum_{i=1}^{n} [(O_{joi}-O_{jui})*P_j)]n^{-1} \quad \text{[Eq. 3]}$$

where:

SS_{diff} is the average difference in gross shelled stock value per Mg between overs and unscreened lots,

O is the shelling outturn in pounds per farmer stock Mg,

P is the price per pound for each shelled category, and

j represents shelled stock outturn categories as defined (Table 1).

Table 1. Mean farmer stock grade factors and value per ton in unscreened and overs lots (n = 394).

	Unscreened[a]	Overs
	%	%
SMKSS	72.39 a	72.99 a
LSK	5.12 a	0.82 b
OK	4.89 a	5.11 a
DAM	0.35 a	0.36 a
HULLS	22.31 a	21.44 b
FM	4.22 a	1.89 b
MC	8.56 a	8.55 a
Value ($/Mg)	$630.58 a	$659.73 b

[a]Means followed by the same letter within rows are not significantly different at P = 0.05 as determined by Duncans new multiple range test.

The gross value of shelled stock peanuts is based on the outturn productivity of farmer stock peanut lots, LSK percentage, shelling plant efficiency which includes the ability of the sheller to recover LSK into edible markets. Thus, Eq. 3 must be summed across both specific LSK percentages in FS lots and LSK recovery levels within LSK percentages:

$$SS_{lsk} = \sum_{i=1}^{n} \sum_{l=1}^{L} \sum_{r=0}^{100} [(O_{joi}-O_{jui})*P_j)]n^{-1}-C \quad \text{[Eq. 4]}$$

where:

SS_{lsk} represents the average difference in gross shelled stock lot value per Mg between unscreened and overs lots across all LSK and LSK recovery levels,

r represents percent recovery levels of LSK ranging from 0 to 100% in 10% increments, and

C represents cost differences associated with shelling and handling overs versus unscreened lots.

Based on the previous studies, improvements in the quality of farmer stock peanuts should decrease C which would improve the feasibility of screening. Further, removal of high risk components should decrease risk associated with aflatoxin and its removal by further processing (blanching, remilling) in shelled stock peanuts. In this study, C is assumed to be zero.

Subtracting Eq. 1 from Eq. 3 provides the average difference in value a sheller could expect from purchasing and shelling overs lots as compared to unscreened lots. The difference in Eq. 2 and Eq. 4 provides the average difference in value within specific integer levels of LSK in the unscreened lots. By specification, if SS_{lsk} is greater than zero, then shellers should either be indifferent to or would be financially advantaged by purchasing and shelling overs lots instead of unscreened lots. Conversely, a SS_{lsk} value less than zero suggests that it is to the shellers' advantage to purchase and shell unscreened peanut lots. Thus, the null hypothesis ($SS_{lsk} = 0$) to be tested is whether shellers would be at an advantage to purchase FS peanuts as overs instead of unscreened lots. A t-test was used to test the hypothesis for the entire data set as well as different levels of LSK in FS lots and the potential LSK recovery level (range 0 to 100%) in the overs and unscreened lots.

Results and Discussion

Average farmer stock grade factors and quota value per Mg in the unscreened and overs lots are contained in Table 1. Significant differences (P = 0.05) in LSK, HULLS, FM, and farmer stock value resulted. No significant differences (P = 0.05) resulted in SMKSS, OK, DAM, and moisture content (MC). Mean farmer stock quota value was $29.15/Mg higher in the overs lots compared to the unscreened lots (P = 0.05) (Table 1). The implication of this value increase is a higher input cost to shellers when purchasing overs lots. With LSK in the overs lots reduced to less than 1%, the ability of the sheller to recover significant amounts of LSK into edible channels is limited (Table 2). In the unscreened lots, average LSK were over 5% which provides more LSK for recovery into edible channels. The impact of LSK on the farmer stock value is illustrated for the unscreened and overs lots in Fig. 1. Due to the lower value of LSK and the deduction of LSK against quota poundage, the value per Mg of farmer stock peanut decreases as LSK increases (Fig. 1). In the overs lots, LSK and other grade factors were not significantly different and the quota value of the overs lots did not significantly change (Fig. 1). The slight increase in value in the overs is attributed to the increase in SMKSS (Fig. 1). The difference in the purchase cost to shellers is illustrated in Fig. 2 also. For 1% LSK in the unscreened lots, the difference is $12.33/Mg more to purchase the same peanuts as overs after screening. At 10%, the difference in the per ton value increases to $57.57/Mg.

The mean shelling outturns and gross shelled stock value in the unscreened and overs lots for LSK recovery 0 and 100% are provided in Table 2. In the unscreened lots, whole kernel outturn of jumbos, mediums, and No. 1s were 2.2, 11.9, and 3.4 kg higher for the full LSK recovery compared to no LSK recovery, respectively. The gross shelled stock value was significantly increased (P = 0.05) in the unscreened lots by $19.95/Mg through full LSK recovery. In the overs lots, the jumbos, mediums, and No. 1s were increased by only 0.4, 2.2, and 0.6 kg, respectively. The increase in gross shelled stock value in the overs lots for 0 and 100% LSK recovery levels was not significantly different from zero.

Table 2. Mean outturn per ton and gross value of shelled stock lots for unscreened and overs lots with 0 and 100% LSK recovery.

	Unscreened LSK recovery level			
	Unscreened		Overs	
Outturn class	0	100	0	100
	----------% ---------		----------% ---------	
Jumbos	137.5	139.9	147.9	149.4
Mediums	324.0	338.3	337.2	339.6
No. 1s	73.6	77.5	72.1	72.8
US splits	111.6	112.9	117.7	118.6
Oil stock	110.6	90.8	98.4	78.7
Gross value ($/Mg)	$904.37	$924.32	$936.74	$935.14

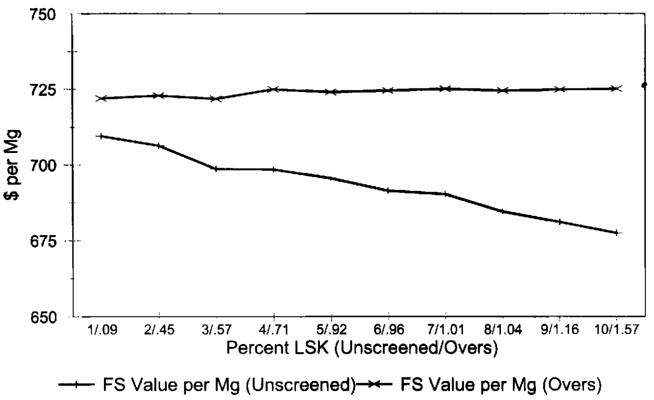

Fig. 1. Quota value per ton of farmer stock peanuts from unscreened and overs lots for increasing levels of loose shelled kernels.

Table 3 provides a matrix of the differences in returns resulting from purchasing and shelling unscreened lots compared to overs lots for combinations of unscreened LSK and LSK recovery levels. The differences are graphically illustrated in Fig. 2 for 0, 50, and 100% LSK recovery levels. Regions left of the intersection of the farmer stock value difference and the respective shelled stock margins represent LSK levels in which the sheller should prefer to purchase screened lots. Conversely, regions right of these intersections represent LSK levels in which it is to the shellers' advantage to purchase unscreened lots. The differences range from $20.39/Mg

(1% LSK with 0% recovery) to -$73.36/Mg (10% LSK with 100% recovery). Based on Eq. 1, negative return differences indicate that shellers should prefer to purchase unscreened lots and, conversely, positive return differences indicate shellers should prefer to purchase overs lots. The shaded region in Table 3 contains the return differences which are not significantly different from zero (P = 0.05). The unshaded region in Table 3 contains values, both positive and negative, which significantly differ from zero (P = 0.05). With each recovery level, the change in return differences is primarily associated with the change in purchase cost of farmer stock peanuts (Fig. 1). As farmer stock LSK increase, the quota value per Mg of farmer stock peanuts decreases, thus lowering the purchase cost to shellers (Figs. 1 and 2). Screening removed a significant amount of LSK and slightly increased the SMKSS, which increased the purchase cost of overs lots to shellers. As LSK in the unscreened lots increased, significant differences between the value per Mg of unscreened and overs lots result. Several combinations of LSK and recovery levels exists where the return differences, both positive and negative, were significantly different from zero (P = 0.05).

Additional research is needed to determine the sign and magnitude of the variable C in Eq. 4. The data indicate shifts in shelling outturn distributions to higher value kernels such as jumbos and mediums from shelling overs lots compared to unscreened lots. However, this increase in shelled stock lot value does not always exceed the increased farmer stock purchase cost associated with purchasing overs lots compared to unscreened lots for certain grade factors of peanuts. The literature suggests that removal of high risk kernels will decrease aflatoxin, which should translate directly into improved shelling efficiency due to reductions in the volume of suspect kernels during shelling. This will ensure meeting aflatoxin specifications in domestic and export markets and should translate into reducing costs associated with handling, processing, and marketing overs lots compared to unscreened lots. Research is planned to address the impact of screening farmer stock peanuts on C and overall feasibility of shellers' purchasing overs versus unscreened lots.

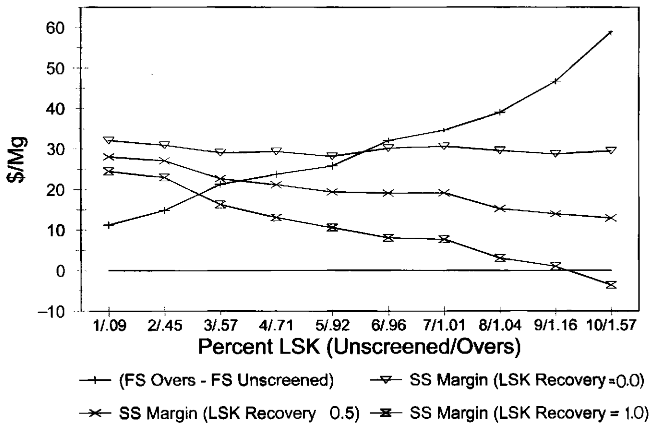

Fig. 2. Difference in quota value per ton of farmer stock peanuts from unscreened and overs lots and difference in shelled stock value per ton from unscreened and overs lots for increasing levels of loose shelled kernels and LSK recovery levels.

Table 3. Difference in returns from purchasing and shelling unscreened (UN) versus overs (OV) lots with increasing levels of recovery of LSK into edible peanuts.

LSK		% LSK recovery into edibles from FS LSK[a]										
UN	OV	0	10	20	30	40	50	60	70	80	90	100
------------% ------------		---------- $----------										
1	0.09	20.39	19.81	19.23	18.65	18.06	17.48	16.90	16.33	15.74	15.16	14.57
2	0.45	17.28	16.15	15.02	13.89	12.77	11.63	10.51	9.38	8.25	7.12	5.99
3	0.57	9.77	8.38	6.97	5.56	4.16	2.76	1.93	-0.04	-1.44	-2.84	-4.25
4	0.71	6.56	4.23	2.43	0.65	-1.13	-2.93	-4.72	-5.53	-8.30	-10.10	-11.90
5	0.92	2.60	.07	-1.28	-3.22	-5.15	-7.08	-9.02	-10.96	-12.90	-14.83	-16.77
6	0.96	-2.06	-4.50	-6.93	-9.36	-11.80	-14.22	-16.66	-19.09	-21.54	-23.96	-26.39
7	1.00	-7.02	-9.54	-12.07	-14.60	-17.12	-19.65	-22.18	-24.71	-27.25	-29.77	-32.29
8	1.04	-9.31	-13.18	-15.84	-19.43	-21.92	-24.42	-28.01	-31.61	-34.10	-36.59	-40.20
9	1.16	-19.88	-25.22	-27.56	-30.41	-33.25	-36.10	-38.95	-41.79	-44.65	-47.49	-50.35
10	1.57	-21.97	-24.71	-30.58	-35.92	-41.28	-46.64	-52.00	-57.31	-62.67	-68.01	-73.36

[a]Shaded numbers are not significantly different from zero (P = 0.05). Note: Positive return differences indicate that shellers should prefer to purchase overs lots and, conversely, negative return differences indicate shellers should prefer to purchase unscreened lots.

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