April 2021

Effects of Mechanical Shelling on Storability of Peanut Seed

C. C. Baskin

James C. Delouche

EFFECTS OF MECHANICAL SHELLING ON STORABILITY OF PEANUT (*ARACHIS HYPOGAEA* L.) SEED[1]

CHARLES C. BASKIN AND JAMES C. DELOUCHE[2]

Mississippi State University
State College, Mississippi

ABSTRACT

Unshelled, handshelled and mechanically shelled peanut seed were stored under several conditions for periods up to 48 weeks. Germinability of mechanically shelled peanuts declined much more rapidly than that of handshelled seed or seed stored in the shell (pod) except for seed stored at 5°C-40% relative humidity. There was no conclusive evidence that the pod itself retarded rate of deterioration.

These data indicate that peanut seed should be stored in the pod until 4-6 weeks before planting season unless cold, dry storage facilities are available.

Additional index words: Groundnuts, relative humidity, mechanical damage.

INTRODUCTION

Current practice in much of the peanut seed industry is to store unshelled peanuts in bulk storage houses after harvesting and drying. Seed are shelled in late winter or early spring, cleaned, treated and bagged shortly before marketing. Since insects are difficult to control in bulk storage and storage space required for shelled peanuts is only 35 to 40 percent that of peanuts in the hull, there has been considerable interest in shelling in the fall shortly after drying, and holding shelled seed in storage until market time the following spring. The success or failure of such a practice will depend on how long mechanically shelled seed retain their planting value under the storage condition available to the seed processor.

Removal of the hull (pericarp) before planting is desirable to insure rapid, uniform germination. Mechanical shelling is a very damaging process at best (5). The thin, fragile seed coat of the peanut offers little protection from mechanical abuse, while the slight protrusion of the radicle tip beyond the basal portion of the cotyledons makes it particularly vulnerable to damage. Mechanical damage hastens deterioration of peanut seed (2, 9) and other seeds (8, 10) in storage.

Several studies (3, 4, 6, 7, 9) have shown that high relative humidity (80% or higher) greatly reduces the storage life of mechanically shelled and handshelled peanut seed even at temperatures as low as 0° to 5° C. Bass (3) and Mathur *et al* (7) suggested that a temperature of 20°C or less is desirable for storage, particularly if relative humidity is not controlled. None of these studies, however, compared the longevity of unshelled and mechanically shelled peanuts of the same lots. This study was undertaken to determine whether the rapid decline

[1]Journal Paper No. 2194 of the Mississippi Agricultural and Forestry Experiment Station, Mississippi State University, State College, Mississippi.

[2]Extension Agronomist, Mississippi Cooperative Extension Service and Agronomist, Mississippi Agricultural and Forestry Experiment Station, respectively.

in germinability of shelled peanuts was due to damage incurred during mechanical shelling or to some other factors associated with shell removal and to compare the longevity of shelled and unshelled peanuts under climatic conditions of the Southeastern United States.

Materials and Methods

Mechanically shelled and unshelled Spanish peanuts of three lots were obtained from commercial sources: Lot A, Starr cultivar from Georgia in 1967; Lot B, Starr cultivar from Texas in 1967; and Lot C, Spantex cultivar from Texas in 1968. The seed were stored at 5°C-40% relative humidity when received and kept in this storage environment until tests were initiated.

Mechanically shelled and unshelled seed of Lot A were stored under controlled environments of 20° and 30°C and 75% relative humidity and in an unconditioned warehouse at State College, Mississippi. Handshelled, mechanically shelled and unshelled seed of Lots B and C were stored at 20°C and 75% relative humidity. This condition was selected because it is somewhat comparable to open storage in the humid Southeast.[1] Samples were taken at six week intervals for germination tests. The storage studies of Lots B and C were repeated after six months (Lot C) and 24 months (Lot B).

Germination tests were made in accordance with the Rules for Testing Seed (1). All seed were treated with recommended fungicides prior to testing.

Results and Discussion

The detrimental effect of mechanical shelling on the storability of peanut seed was quite evident. Differences in rate of germination of handshelled and mechanically shelled seed at the time the seed were placed in storage suggest that the mechanically shelled seed were already decreasing in vigor, although final germination percentages were comparable (Table 1).

Table 1. Percent normal seedlings after five days (first count) and final germination percentages of lots of Spanish peanuts at time of initiation of storage studies.

Lot	Handshelled		Mechanically Shelled	
	5 day	Final	5 day	Final
A	76.5	95.0	61.5	95.0
B	78.0	95.5	72.5	93.0
C	78.5	92.0	68.5	89.5

[1]Unpublished data. Seed Technology Laboratory, Mississippi State University, State College, Mississippi.

Mechanically shelled seed of Lot A declined more rapidly in germination than unshelled seed under three storage conditions (Table 2). Germinability of the seed was maintained longer at 20°C-75% RH than at 30°C-75%RH illustrating the moderating effect of cool temperatures on rate of deterioration.

Similar trends were evident from the storage responses of Lots B and C (Tables 3 and 4). Seed of Lot B in the shell maintained germination well through 36 weeks storage 20°C-75% RH. Handshelled seed maintained good germination through 30 weeks storage while mechanically shelled seed rapidly decreased in germination from the beginning and germinated only 55% after 30 weeks. Results obtained from a second storage study with Lot B initiated 24 months later were similar except that germinability of the three types of seed decreased more rapidly. These responses suggest that deterioration and loss of storage potential occurred during the 24 month interval between the two storage studies when seed were stored at 5°c-40% RH.

Results with Lot C generally followed trends observed with Lot B except that there was no difference in storability of unshelled and hand-shelled seed and germination of all types of seed decreased more rapidly. This difference in storability between Lots B and C might have resulted from initial differences in physiological quality, varietal difference or a combination of both physiological and genetic factors. Rate of germination (Table 1) suggested no difference in storage potential between handshelled seed of Lots B and C; however, accelerated aging (Table 5) did indicate this difference.

Table 2. Germination percentages of unshelled and mechanically shelled Starr peanuts (Lot A) at various intervals during storage under three conditions.

Storage Condition	Weeks in Storage											
	0		6		12		18		24		30	
	NS*	MS	NS	MS	NS	MS	NS	MS	NS	MS	NS	MS
30°C-75% R.H.	95	95	90	58	62	47	60	19	60	0	--	--
20°C-75% R.H.	95	95	92	71	92	76	85	62	84	51	74	36
Open	95	95	89	75	89	59	91	50	76	30	72	9

* NS = not shelled; MS = mechanically shelled.

Unshelled and handshelled seed stored much better than mechanically shelled seed in each study. Although unshelled seed of Lot B stored slightly better than handshelled seed, there was little evidence that the shells directly influenced the storability of the seed. The detrimental effect of mechanical shelling on storability, therefore, must be attributed to mechanical injury.

Although 5°C-40% RH was considered as a "holding condition" rather than a storage treatment, the merit of these conditions for storage of peanut seed was obvious. Regardless of the state of processing (mechanically shelled, handshelled,

Table 3. Germination percentages of unshelled, hand shelled and mechanically shelled Starr peanuts (Lot B) after various intervals of storage at 20° C - 75% R.H. (First study initiated soon after receipt of seed; second study initiated 24 months later.)

Weeks in Storage	% Germination		
	Unshelled	Hand Shelled	Mechanically Shelled
	1st Storage Period		
0	95.5	95.5	93.0
6	96.5	97.5	86.0
12	99.0	100.0	88.5
18	99.0	96.0	73.0
24	96.5	96.5	72.0
30	95.5	93.5	55.0
36	95.0	89.0	56.5
42	83.0	77.0	35.5
48	79.5	64.5	36.5
	2nd Storage Period (Seed held 24 months at 5° C - 40% R.H.)		
0	98.5	98.5	94.0
6	92.5	96.0	72.5
12	96.5	89.5	78.5
18	92.5	96.0	69.5
24	86.5	87.5	43.5
30	84.0	75.5	41.5

unshelled), germination of Lot B seed did not decline during 24 months "holding" storage at 5°C-40% RH.

Mechanical shelling of peanut seed markedly reduced storability except under optimum conditions of 5°C-40% RH. Even then, the results of accelerated aging (Table 5) indicate that mechanically shelled seed would have declined in germinability more rapidly than handshelled or unshelled seed had the storage period been extended longer than 24 months.

When seed were stored under uncontrolled conditions or at 20°C-75% RH, which is roughly comparable to open storage conditions in the humid Southeast, germination began to decrease after 6 to 30 weeks of storage regardless of the state of processing.

Table 4. Germination percentages of unshelled, hand shelled and mechanically shelled Spantex peanuts (Lot C) after various intervals of storage at 20° C. - 75% R.H. (First study conducted soon after receipt of seed; second study conducted 6 months later.)

Weeks in Storage	% Germination		
	Unshelled	Hand Shelled	Mechanically Shelled
	1st Storage Period		
0	92.0	92.0	89.5
6	80.5	83.5	80.0
12	83.5	83.5	72.5
24	58.5	66.5	38.0
30	36.0	30.0	8.0
36	41.5	40.5	10.0
	2nd Storage Period (Seed held 6 months at 5° C - 40% R.H.)		
0	92.0	92.0	89.5
6	85.5	80.5	70.0
12	79.5	71.5	58.5
18	60.5	64.0	36.5
24	60.5	47.5	24.0

Table 5. Germination percentages of Spanish peanuts after intervals of storage at 20°C - 75% RH and after accelerated aging for 72 hours at 42°C - 100% RH.

Lot		Time in storage (weeks) 0	12	24	After accelerated aging
A	HS*	95	92	84	79
	MS	95	76	51	37
B**	HS	96	100	96	91
	MS	93	88	72	40
B_2	HS	98	90	88	91
	MS	94	78	44	40
C_1	HS	92	84	66	74
	MS	90	72	38	38
C_2	HS	92	72	48	74
	MS	90	58	24	38

* HS = Hand shelled; MS = Mechanically shelled

** Subscript 1 and 2 refer to study 1 and study 2

These results suggest that after drying and cleaning peanut seed should be stored in the shell in a warehouse conditioned to less than 20°C-75% RH until four to six weeks before planting. If early shelling is practiced, the shelled seed should be stored under cold room conditions, *i.e.*, 5°-10°C and 40 to 50% RH.

Literature Cited

1. ASSOCIATION OF OFFICIAL SEED ANALYSTS. 1965. Rules for testing Seeds. Proc. Assoc. Off. Seed Anal. 54(2):1-112.
2. BASKIN, C. C. 1970. Relation of certain physiological properties of peanut (*Arachis hypogaea* L.) seed to field performance and storability. Dissertation (Ph.D.) Mississippi State University, State College, Mississippi.
3. BASS, L. N. 1968. Effects of temperature, relative humidity and protective packaging on longevity of peanut seeds. Proc. Assoc. Off. Seed Anal. 58:58-62.
4. BEATTIE, J. H., A. M. JACKSON and R. E. CURRIN. 1932. Effect of cold storage and age of seed on germination and yield of peanuts. U.S.D.A. Circ. No. 233. 12 pp.

5. GAVRIELITH-GELMOND, H. 1962. A review of problems associated with testing peanut seed *(Arachis hypogaea)*. Proc. Int. Seed Test. Assn. 27(2): 357-372.

6. KETRING, D. L. 1971. Physiology of oil seeds III. Response of initially high and low germinating Spanish-type peanut seed to three storage environments. Agron. J. 63:435-438.

7. MATHUR, P. B., M. PRASAD and K. KIRPAS SINGH. 1956. Studies in cold storage of peanuts. J. Sci. Food and Agri. 7:354-360.

8. TOOLE, E. H. 1950. Relation of seed processing and of conditions during storage on seed germination. Proc. Int. Seed Test. Assn. 16:224-227.

9. VAUGHAN, C. E. 1969. Tetrazolium evaluation of the nature and progress of deterioration of peanut *(Arachis hypogaea* L.) seed in storage. Dissertation (Ph.D.) North Carolina State University, Raleigh, North Carolina.

10. ZINK, E. 1966. Immediate and latent effects of mechanical abuse on the germination of soybean seed. Thesis (M.S.) Mississippi State University, State College, Mississippi.