is focused on two types of seed: (1) light colored, easy-to-decorticate seed with a pleasant flavor for use as whole seed by the bakery and confection industries; (2) high oil content seed, rich in linoleic acid for the oil processing industry.

Analyses of the available seed stocks indicated that oil contents range from 47 to 56%. Determinations of the chemical composition of the oil of those samples revealed considerable variation in fatty acid content (palmitic acid 6–12%, stearic acid 2–9%, oleic acid 32–49% and linoleic acid 35–52%). The range in the iodine value of the oil extended from 106 to 126. It is believed that if seed analyses of single plant selections were made, the variability in the content and composition of the oil would be much greater. A great amount of variability is also available in these stocks in terms of maturity, growth habit, and capsule morphology. Some of the variable traits observed, like the flattened stems shown in plant photos, may have no more value than genetic oddities often observed in crops. Others, however, like the multi-carpelate capsules (seed photo) or the strong placenta attachment which tends to hold the seed in the capsule in spite of dehiscence might prove to be very valuable traits to incorporate in commercial varieties.

Further research is needed to reach the desired plant breeding objectives and to determine the optimum cultural practices for sesame. Nevertheless, the high content of premium quality oil, superior flavor, and nutritive value of the seed makes sesame an extremely promising oilseed crop for California.

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Lateral pressure effects on . . .

HAY WAFER STORAGE STRUCTURES

L. W. NEUBAUER · J. B. DOBIE · R. G. CURLEY

Hay wafering has been developed to improve the handling characteristics of forage. Wafered hay lends itself to bulk handling and because of its greater density and flowability, permits heavier loading of storage structures.

Pressure wall (8 × 8 ft) used in first test.

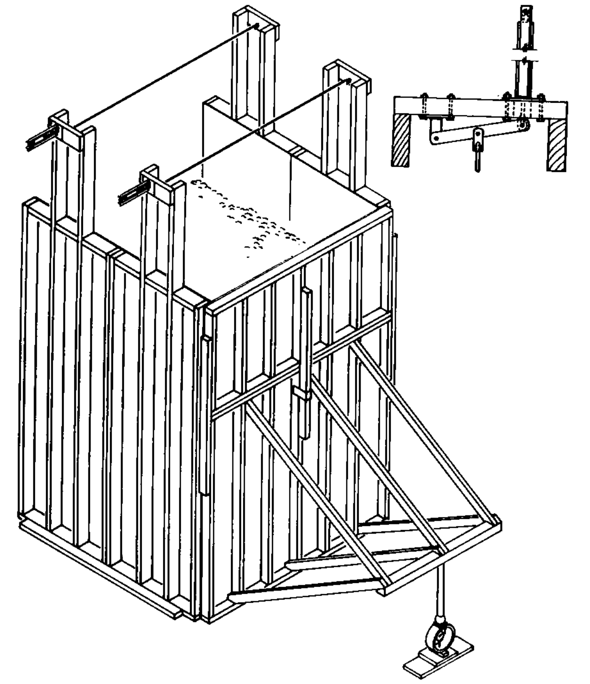
But as production of wafers has increased, deep piling of wafers in storage has caused concern regarding the lateral pressure for which storage structures should be designed. Dairymen have constructed self-feeding barns capable of storing 400 to 500 tons of wafers, with little information on structural requirements to withstand the pressures. Where wafers have been stored in barns designed for baled hay, piling along sidewalls has generally been kept to a minimum, resulting in considerable loss of storage capacity.

Hay wafers vary in size, shape, and density. In bulk, the amount of fines varies from one load to the next. All of these physical characteristics affect the flowability and the lateral pressure of wafers. The width, length, and depth of storage may be expected to affect lateral pressure for any particular wafer. Data reported here are from tests under specific limited conditions, but should be helpful in designing safe wafer storage structures.

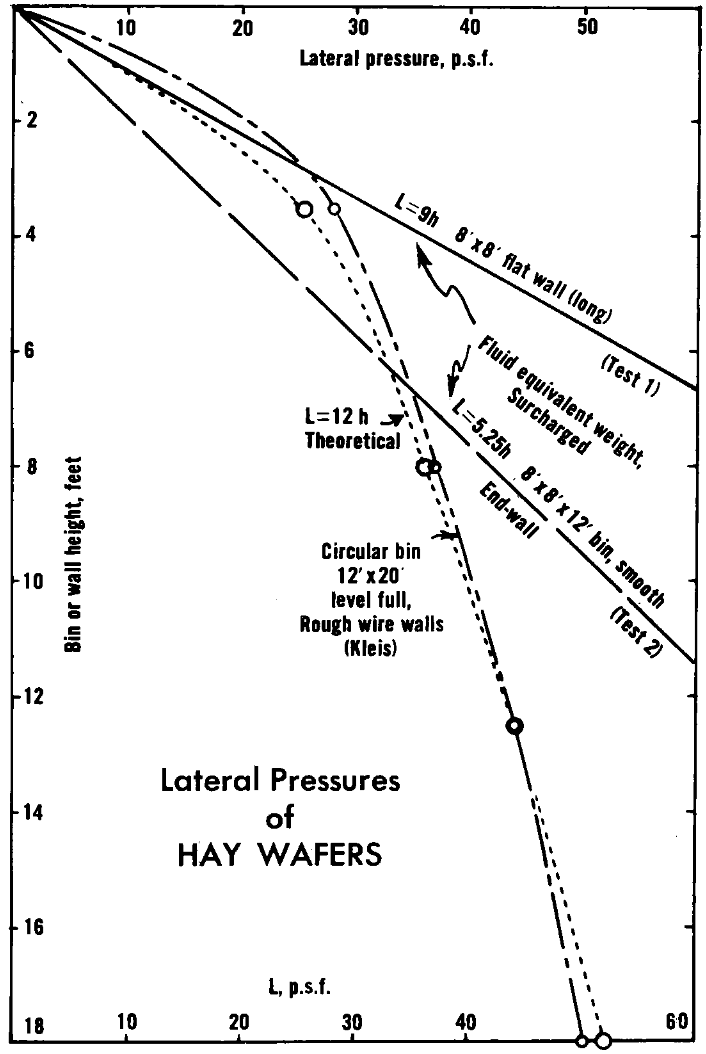
Tests were conducted on two different flat wall installations. The first test was made with a single 8×8 ft wall, hinged at the bottom, and supported through a framework to a pressure-measuring device. Wafers were piled against the flat side of the wall, and the pressure was measured at various average contact depths of wafers, as shown in the photo. Plywood was fastened on the ends of the panel, extending away from the pile of wafers, to reduce the effect of wafers rolling around behind the pressure wall.

In the second test, four 4×12 ft panels were erected to form two opposing walls 8 ft wide by 12 ft high and 7½ ft apart. They were supported against lateral movement at the base and each pair of opposing 4×12 ft panels was connected by a steel rod through framework extending from the top of each panel as shown in the drawing. The rod was connected to a tension scale to measure the outward pressure between the walls. An 8×12 ft panel was placed against the ends of the 4 × 12 ft panels to form a three-sided structure. Pressures were recorded on the 8 × 12 ft panel with the same device described in the first test to provide data approximating end-wall conditions. A large pile of wafers formed the fourth side. Pressure readings were taken for each 6-inch increment of depth.

Storage facilities being constructed or remodeled to contain hay wafers rather than bales, must have walls designed to withstand the increased lateral pressures created by the greater density and flowability of the wafers. This study suggests possible design standards for wall strength in rectangular storage buildings.



Drawing of pressure walls used in second test. Tension scales are shown at left top. Multiplier is shown in detail. Pile of wafers formed the fourth side of bin.



In each test, wafers were piled against the wall with a drag-type elevator—delivering the wafers at a point 4 to 6 ft from the wall and high enough to form a normal cone with a 45 degree angle of repose at maximum wafer depth. This provided surcharge storage conditions on the pressure walls. Wafers contacted the walls along a curved or conic section, and average height was carefully estimated.

Wafers used in both tests were 1¼ × 1¼ inches, varying from ½ to 2 inches in length. The wafers used in the first test averaged 20.6 lbs per cubic ft bulk density and 21.8% fines. In the second test, these figures were 22.7 lbs and 32.1%, respectively.

Results and conclusions

The first test indicated a fluid-like variation in lateral pressures existed at several depths. The value of the equivalent fluid weight for the wafers tested was found to be 8.91 lbs per cubic ft. Using a value of 9.0 for design purposes, the lateral pressure, L, in pounds per square foot of wall, can be expressed as: **L = 9h** where h is the depth of wafers in feet, at the wall above the point where the pressure was being calculated. This situation is believed to approximate the pressures on a long continuous wall without the effects of end-walls or partitions.

Data from the second test also indicated an equivalent fluid condition. By the same method of computation, the mean value of W was found to be 5.25 lbs per cubic ft equivalent weight. This appeared to be surprisingly small, and much less than

STUD AND WALL MATERIAL SIZES IN FLAT WALLS FOR HAY WAFER STORAGE

Plate or tie height above floor	Stud spacing—center to center				Pole spacing	
	12 in.	16 in.	24 in.	48 in.	8 ft.	12 ft.
8 ft.	2 × 4 studs ¾" s*–⅜" p*	2 × 4 studs ¾" s – ⅜" p	2 × 4 studs ¾" s – ½" p	2 × 6 studs 1" s – ¾" p	5" D poles 2" s	6" D poles 3" s
12 ft.	2 × 4 studs ¾" s – ⅜" p	2 × 6 studs ¾" s – ⅜" p	2 × 6 studs ¾" s – ½" p	4 × 6 studs 1" s – 1" p	7" D poles 2" s	8" D poles 3" s
16 ft.	2 × 6 studs ¾" s – ⅜" p	2 × 6 studs ¾" s – ⅜" p	2 × 8 studs ¾" s – ½" p	4 × 6 studs 1" s – 1¼" p	8" D poles 3" s	9" D poles 4" s
20 ft.	2 × 6 studs ¾" s – ⅜" p	2 × 8 studs ¾" s – ⅜" p	4 × 6 studs ¾" s – ⅝" p	4 × 8 studs 1½" s	10" D poles 3" s	11" D poles 4" s
24 ft.	2 × 6 studs ¾" s – ⅜" p	2 × 8 studs ¾" s – ½" p	4 × 6 studs ¾" s – ⅝" p	6 × 8 studs 1½" s	11" D poles 3" s	12" D poles 4" s

* s = siding in actual thickness of clear lumber; p = plywood.
Note: Poles are round and tapered. Diameters are at the middle.

results from the previous test. The explanation of this differential probably lies in the arrangement of the testing equipment. In the first case, the test-wall was fully exposed to the lateral pressures of the wafers, while in the second case an end-wall was used, together with an established pile of wafers forming the fourth wall. This, in effect, constituted an 8×8 ft bin, 12 ft high, with end-walls subject to friction, and reduced the lateral pressure effects. Such a low pressure condition indicated in the equation $\mathbf{L = 5.25\ h}$, should, therefore, not be recommended for most storage buildings, but only those of proportions similar to the test conditions.

In a separate experiment performed by R. W. Kleis and T. Cleaver to study the use of shade fence construction of a low-cost 12-ft-diameter cylindrical storage facility for wafers, the tension in the lower 5-ft ring of fence was measured at various increments of wafer depth up to 20 ft. In this case, lateral pressure variations were entirely changed. Data did not indicate a fluid equivalent condition, but relations similar to those in grain storage facilities. A parabolic pressure pattern was indicated, and computations led to a simplified approximation: $\mathbf{L = 12\ \sqrt{h}}$. This relationship is shown plotted on the graph, together with the curve from the Kleis-Cleaver data. The straight lines for equivalent fluid weight of 5.25 and 9.0 lbs per cubic ft are also shown.

Wide range

The wide range of pressures should warn an engineer that the exact condition should be carefully studied in designing walls for wafer storage. Light construction should be used for economy whenever possible, but for deep piling against a long wall, heavier construction, assuming high fluid effects, must be provided.

Based on the pressure data obtained in the first test ($L = 9h$), and experience with existing structures, the design information in the table is suggested for the walls in rectangular storage buildings. The recommendations reported here are the results of rather limited studies, and while they cannot be considered as entirely precise and complete, they are believed to be reasonably substantial and accurate—and useful in designing walls for the specified conditions.

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Development of Scion Roots On Old Home Pear Trunks

R. L. RACKHAM • G. W. MOREHEAD

Application of a rooting hormone to encourage early scion root initiation may eventually result in elimination of a need for the bud union between the Old Home pear trunk and the original rootstock and will establish the trees on a more vigorous root system, according to tests detailed in this progress report of field research by Extension Service staff members.

IN THIS STUDY, various techniques were compared for the development of scion roots from the trunks of one-year Old Home pear trees budded on Domestic French rootstocks. The trees were planted with Old Home-Domestic French unions 10 to 12 inches deep in a clay loam soil in anticipation of Old Home root development above the union. Treatments with root hormones were made September 17, 1962, and results were obtained by excavation and measurement of roots December 10, 1963.

Three replications of 12 treatments included the application of indolebutyric acid in concentrations of 500, 5,000, and 10,000 parts per million (ppm) into a cut made with a hacksaw blade around the circumference of the trunk. A cut was made through the bark to the wood at 2

Numerous scion roots developed in 15 months following IBA and Dexon application 4 inches below the soil surface. Ballpoint pen offers size comparison with roots and trunk.