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

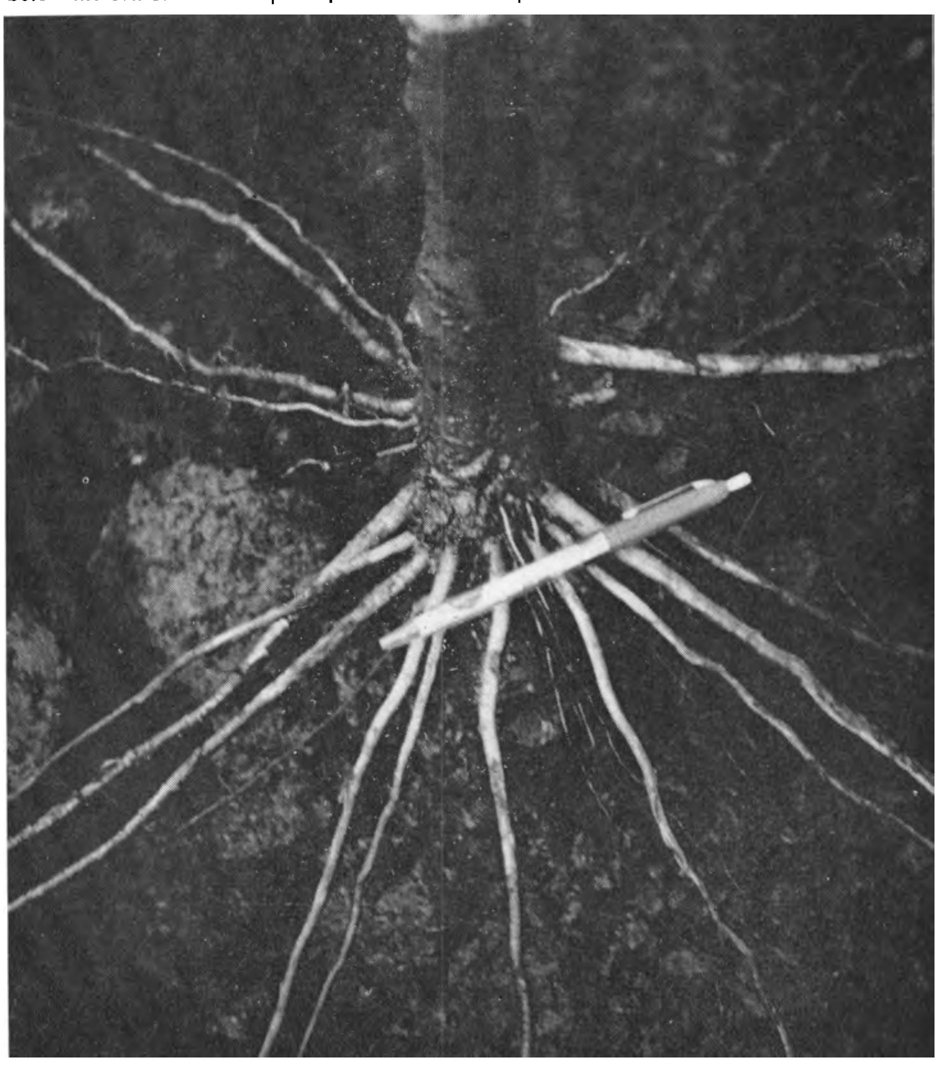
R. L. RACKHAM • G. W. MOREHEAD

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.



and 4 inches below the level soil surface. The ring of frayed bark at this scored area absorbed adequate amounts of the rooting hormone when applied at the highest concentration with a one-inch paint brush.

After the soil was replaced to the point of treatment, Dexon, a fungistat specific for water mold fungi, was applied at the rate of 4.15 grams of 70% wettable Dexon, watered into a basin 18 inches in diameter around the tree with 3.5 gallons of water. This resulted in a 100-ppm concentration in the soil around the tree, wet approximately 1 foot deep.

In addition to these 12 treatments, trees were girdled at 2- and 4-inch depths with a single strand of baling wire wrapped tightly about the trunk. The bark of the check trees was cut, but no rooting hormone was applied.

Approximately 1 cubic foot of wood shavings was then spread in the basins around each tree for moisture conservation and held in place with a thin layer of soil. Normal orchard sprinkler irrigation kept the rooting area adequately moist.

On May 16, 1963, roots were found growing from the treated areas on some of the trees. All tree sites were carefully excavated December 10, 1963, and the total length of all roots originating from the treated area on the Old Home trunks was measured.

Deep-planted, one-year-old pear trees were scored around the trunk with a saw blade at 2 and 4 inches below the soil surface. Indolebutyric acid, a rooting hormone, was applied in this cut with a paint brush to stimulate scion root development.

Analysis

In the analysis of variance, the interaction of indolebutyric acid concentrations vs. depth was highly significant. Ten thousand ppm IBA treatments were generally best and scoring at the 4-inch depth was generally best. When these treatments were combined, some single roots grew as much as 60 to 80 inches long and were ½ to ¾ inch in diameter near the tree trunk during the 15 months following treatment.

Although this treatment rate appears to be satisfactory, higher concentrations of IBA applied at deeper depths might have proven even more successful. At the onset, however, these levels appeared to be near the maximum practical limits, according to related research by University of California pomologists. Excellent rooting results had been obtained on Old Home hardwood cuttings with 2,000 ppm of IBA. Most Old Home pear trees on Domestic French roots are not planted with the bud union deeper than 4 to 6 inches below the soil surface, and observations made in Oregon indicated that bud unions 2 inches deep were at the best point for scion root development in untreated Old Home trees.

Root development is retarded by both low oxygen and low temperature if trees are planted too deep. Apparently the mulch of wood shavings compensated for these factors because more roots developed at the 4-inch level where soil moisture was higher.

The interaction of Dexon vs. depth of IBA treatment was significant at the 5% level in the analysis of variance, as illustrated in the table at both 5,000 and 10,000 ppm of IBA when applied 4 inches below the soil surface. The addition of Dexon resulted in significantly more root growth at the 4-inch depth but was of no benefit to similar treatments at 2 inches.

Five of the 12 trees treated with 500 ppm of IBA developed only a few scion roots, indicating that this concentration was too low. One out of three check trees which had the bark cut, but were not treated with IBA, developed a few fine rootlets which appeared very weak, although a ring of callus tissue developed on all of them.

A proliferation of small rootlets developed on five of the six trees girdled with wire. These roots appeared unthrifty and many were rotted. The stock of one tree was dead below the wire girdle but the scion roots supported the growth of the tree. There was no difference between the 2- and 4-inch depths of girdling.

Trunk circumferences measured at the soil line were not consistently correlated with the development of scion roots. Trees in the treatment resulting in the most scion root development did, however, have the largest trunks. This technique—using 10,000 ppm of IBA applied in a saw score about the trunk, 4 inches deep—provides a method for establishing young, deep-planted Old Home pear trees on their own roots. The method should be investigated for Bartlett pear scions and any other species of trees where scion roots are desirable.

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SCION ROOT DEVELOPMENT AND TRUNK CIRCUMFERENCE EFFECTS OF ROOTING HORMONES AT 5,000 AND 10,000 PPM AND 2- AND 4-INCH DEPTH WITH (+) AND WITHOUT (–) FUNGISTAT

Ppm IBA	Treatment depth (inches)	100 ppm Dexon	Trunk circumference (inches)*	Total length of roots per tree†	Remarks
0	2	–	4.37	20	Roots only on one tree, all <⅛" diam.
5,000	2	–	5.21	36	Roots only on one tree
5,000	2	+	3.92	99	Some root rot; one girdled below scion roots
5,000	4	–	5.13	33	Roots on 2 trees, all <½" diam.
5,000	4	+	4.73	283	4 roots ½" diam.; looks very good.
10,000	2	–	4.58	314	Some rotted roots but most looked good and were well distributed.
10,000	2	+	4.52	153	Roots only on west side of one tree.
10,000	4	–	4.88	496	Large roots very good; many small roots rotted.
10,000	4	+	5.54	735	Very well distributed roots, one 80" long, ¾" diam., no evidence of root rot.
L.S.D.	5%			222	
	1%			300	

* Average of 3 trees.

† Average of 3 trees measured in inches. Total of all roots originating from point of circumscore with a saw.