Viability of Sugar Beet Seed Held in Cold Storage for 22 Years

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On March 8, 1928, two 5-pound sugar-beet-seed samples were placed in a commercial refrigeration cold-storage house at Salt Lake City, Utah, by the senior writer. The seed used was the German variety, Braune, reproduced at St. George, Utah, in 1927. This seed was run over a 7/64-inch screen to take out the very small seed balls. The seed was placed originally in two metal containers, one of which was sealed. By 1938 these containers rusted and became perforated with holes. At that time the seed was transferred to cloth sacks. Temperatures over the period of years have ranged from +10° F. to —10° F. but have been held constantly below freezing.

Germination records over a period of years are shown in Table 1. Some variation is expected in these results due to small differences in methods of sampling and technique of running the tests. In 1942 Stout and Tolman's improved method[2] of preliminary washing in running water was initiated. Temperatures during germination tests varied from 20° C. to 25° C. but all tests were continued for 14 days to obtain complete germination from all seed balls. Duplicate 100-seed-ball samples were germinated at all dates. After 22 years the tests showed 75 percent germination.

It was thought advisable to obtain information on the vigor of plants grown from the seed held in cold storage for as long as 20 years. Measurements of seedling vigor were considered but observations showed that the old seed produced seedlings with approximately the same vigor as seedlings from current commercial sugar beet seed lots. Any significant differences, therefore, would have required a very precise technique. Considering the difficulties of such technique it was deemed advisable to make a test under field conditions. Table 2 shows results obtained by G. K. Ryser giving comparisons between the seed held in cold storage and the seed from the curly-top-resistant variety US 22/3 produced at Avon, Utah, in 1946. Two-row plots 60 feet long were replicated twice again in 1948. In 1949 two-row plots 29 feet long of each variety were replicated three times. These field

Table 1.—Germination of sugar beet seed held 21 years in cold storage (1928-1949).

Date	Length of storage years	Percent germination	Tested by
1928	0	83.5	D. A. Pack
1942	14	86.5	Myron Stout
1947	19	85.0	W. J. Musser
1948	20	75.0	Betty Nielsen
1949	21	81.0	Betty Nielsen
1950	22	75.0	C. H. Smith

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[2] Factors affecting the germination of sugar-beet and other seeds with special reference to the toxic effects of ammonia.—Myron Stout and Bion Tolman. Journal of Agricultural Research 63 (12): 687-713, **1941.**

tests were made at Granger, Utah, on soil with good fertility, which produced a luxuriant growth of foliage. The data shown in Table 2 substantiate the field observations regarding the normal vigor of plants grown from seed held in cold storage for the length of time indicated. There was no indication at any time that plants grown from the seed stored 19 to 21 years were deficient in vigor.

Utilization of Information by Plant Breeders

It is common knowledge that the viability of sugar beet seed under storage at low humidity is much superior to storage under high humidity. At Salt Lake City the humidity is low and sugar beet seed stores well for a period of ten years or more. After about 15 years, however, the germination appears to drop rapidly. In 1948 a test was run with seed from some curly-top resistant varieties which had been stored for several years under normal sugar beet seed storage conditions. Seed of variety U.S. 1 stored for 19 years showed 27 percent germination as compared with an original germination of about 80 percent. U.S. 33 stored for 15 years gave 59 percent germination. A sample of the same U.S. 33 seed placed in cold storage in 1938 showed 96.5 percent germination in 1948, which is comparable to the original germination.

The sugar beet breeder is vitally interested in seed storage methods which will prolong the normal viability of his breeding stocks. Evidence indicates that storage in commercial cold storage houses offers one possibility. One drawback with some of the present cold-storage plants is the fire hazard involved. The original storage house in which the seed was first placed at Salt Lake City in 1928 burned in 1949. Fortunately, the seed had been transferred to a new storage house, but at this new location there is some fire hazard, too. Artificial drying and storage in partial vacuum or in carbon dioxide gas may supplement the desirable effect of low temperature. One of the original five-pound seed lots was sealed in 1928 but unfortunately the seal was broken by rusting of the metal container.

The storage test begun in 1928 will be continued and interest in the results will no doubt increase as the years go by. The writers wish to acknowledge and extend thanks to those who conducted the germination tests and to Mr. George K. Ryser who conducted the field comparisons.

Table 2.—Yields from seed held in cold storage for 19, 20 and 21 years, compared with the 1946 seed crop of the commercial curly-top-resistant variety U.S. 22/3—By G. K. Ryser.

Year tested	Acre Yield, Beets			Acre Yield, Gross Sugar		
	U.S. 22/3 seed		Cold storage Braune seed	U.S. 22/3 seed		Cold storage Braune seed
	Tons	Percent[1]	Percent[1]	Pounds	Percent[1]	Percent[1]
1947	35.1	100	96	11,660	100	87
1948	21.2	100	118	6,390	100	102
1949	21.8	100	94	6,104	100	98
Average		100	103		100	96

[1] Figures in percent of U.S. 22/3 yields

Summary

Sugar beet seed was placed in a commercial refrigeration cold-storage house in 1928. In 1950, after 22 years, the percentage germination of this seed was still 75 or about 10 percent less than the original germination in 1928. Agronomic tests in 1947, 1948 and 1949 indicated normal vigor and sugar content after 18 to 20 years storage.