WILL SUPER DEEP FREEZE DAMAGE TREE SEED?

Albert Engstrom, Assistant Forester
Forestry Division, State Department of Agriculture
Oklahoma City, Okla.

Oklahoma's Clark-McNary nurseries store their more valuable tree seeds with a commercial cold storage firm. Good seed has been stored for more than 10 years without appreciable loss in germination. Species, such as the pines, are stored in 5-gallon water bottles on shelves in a cold storage room where the temperature remains a nearly constant -10° F.

What low temperature extremes can tree seed withstand without damage? Cattle breeders store semen for long periods in small vials immersed in liquid nitrogen. Could tree seed be stored like semen? The temperature of liquid nitrogen is -320° F.

To see what would happen, we tested three species in liquid nitrogen storage. Small samples, about 3 ounces each, of Chinese

elm, shortleaf pine, and Russian mulberry seed were taken from our regular commercial cold storage, placed in polyethylene bags, and mailed to a cattle breeder who immediately placed them in liquid nitrogen chests. The samples were to stay in the liquid nitrogen chests for about 30 days, but because of pressing responsibilities, the seed were left there longer. The samples were placed in the liquid nitrogen on April 15 and were withdrawn 112 days later.

Germination tests were made immediately in the Oklahoma State Department of Agriculture Seed Laboratory. The results are shown in the following tabulation:

Species	Treatment*	Percent germination		
		8 Days	14 Days	30 Days
Pinus echinata------- (Shortleaf pine)	A----------	38	46	54
	B----------	30	34	41
	C----------	30	35	44
Ulmus pumila ------- (Chinese elm)	A----------	69	74	75
	B----------	75	75	76
	C----------	51	59	60
Morus alba tortonia-- (Russian mulberry)	A----------	1	1	1
	B----------	1	1	1
	C----------	4	9	11

Treatments: Treatment A.--Sample was placed in 10 cc. plastic bottle 3 days after removal from -10° F. cold storage and plunged into liquid nitrogen at -320° F. It stayed in this medium for 112 days.

Treatment B.--The 10 cc. plastic bottle of seed was held 3 inches above liquid N 2 for 5 minutes until the temperature dropped to -67° F. Then the sample was lowered to 1 inch above liquid N2 for 5 minutes while temperature dropped to -220° F. Finally it was plunged into the liquid N 2 to remain for 112 days.

Treatment C.--These samples were not exposed to the liquid N_2 deep freeze. They were tested for germination immediately after being taken from regular -10° F. seed storage. Since these samples were taken from cold storage 115 days after the samples drawn for treatments A and B, they cannot be considered true check samples. They should be very similar, however, because they were drawn from the same bottles in the cold storage room.

Storage of shortleaf pine and Chinese elm for over 3 months in liquid nitrogen at -320° F. made little or no significant difference in the germination capacity of these seeds. It was obvious from the germination tests that the shortleaf pine was only fair seed at the outset. The Russian mulberry seed was very poor, and may have been damaged by deep freezing.

The question now arises as to the effect of deep freezing on fresh seed. What would happen to more perishable seed such as cottonwood or acorns? Could we place cottonwood catkins in liquid nitrogen chests, and then extract the seed several months later for planting in Argentina, for example?