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ACCELERATED AGING TEST PROCEDURE

James C. Delouche 1/

The accelerated aging test involves the exposure of small samples of seed from the available lots of the same seed kind to very adverse conditions for a specific period. After accelerated aging, the percentage survival of the seed from the various lots is determined by standard germination tests.

Environmental conditions and period of exposure required to obtain maximum differences in response among seed lots vary with the kind of seed. In general, the most satisfactory conditions are 100% relative humidity, temperatures of 40° to 45° C., and exposure periods of 2 to 8 days.

Aging Chamber

Accelerated aging is carried out in a chamber in which the desired environmental conditions are maintained. Temperature and relative humidity must be maintained at desired levels and they must act uniformly on all the samples under test in the chamber.

The chambers used in our studies were constructed from several old - but serviceable - water cooled germinators with 2 1/2 inch insulated walls and doors. Inside dimensions of the chambers are: width, 26 inches; depth, 20 inches; height, 24 inches. All water tubing and other internal equipment were removed except the tray rack. Gaskets were replaced and all holes in the walls and top were closed. The water well or reservoir (about 1 inch deep) in the bottom of the germinator was repaired and sealed to stop all leaks.

The chamber was modified as follows: (Figure 1)

(1) A flexible, immersion type, low drift, heating rod 66 inches long (50 inches active length) was shaped into a rough rectangle in the bottom reservoir of the chamber. The threaded terminal connectors were passed to the outside through two holes drilled in the lower rear wall of the chamber, and were sealed in the holes with glazing compound.

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Figure 1. Interior view of an accelerated aging chamber.

- (2) The heater terminals were then wired to an electrical plug.
- (3) The heating element was connected to a thermistor temperature controller (YSI Model 71) equipped with a general purpose thermistor probe.
- (4) The thermistor probe lead and the stem of a centigrade dial thermometer were passed to the inside of the chamber through small holes drilled in the middle of one side of the chamber.
- (5) A plexiglass chamber was designed as an insert or inner liner for the chamber to increase uniformity of temperature and humidity. The plexiglass liner fits on a rack about 5 inches from the bottom of the chamber and 2 to 4 inches from the side walls, back and ceiling. The liner has a water reservoir, glides for two trays, and a removable access panel in the front.

The top rack of the plexiglass liner is covered with blotters to collect any condensation dripping from the top (actually, very little condensation forms on the top or walls of the liner). The bottom rack is used for holding the samples of seed at a set distance of 3 inches from the surface of the water. A dial, long stem thermometer is inserted through the front access panel of the liner, and a sensitive, glass mercury thermometer is attached to the sample tray placed in the liner.

Operation

In operation, one inch of distilled water is placed in the bottom reservoirs of the chamber and plexiglass liner. An empty tray with attached glass thermometer is placed in the bottom rack of the liner and the doors of each are closed. The temperature controller is energized and adjusted or calibrated to the desired temperature setting with the glass thermometer inside the liner. After the desired temperature is achieved, the tray is removed and samples to be tested are placed in small screen wire baskets on the tray. The tray is replaced in the liner and accelerated aging begun. After aging for the desired number of hours or days, the samples are removed and standard germination tests are made.

The less severe accelerated aging condition of 30°C and 75% R.H., which is apparently best for several kinds of seed, can be easily achieved. A saturated solution of sodium chloride (excess salt in solution) will maintain a 75% R.H. in a closed container. We use a large plexiglass box or humidity chamber and simply place it in a 30°C room.

The most satisfactory accelerated aging conditions for several kinds of seed are given in Table 1. Selection of best conditions for specific situations should be based on highest coefficient of correlation.

Table 1. Summary of best accelerated aging regimes for evaluating the storability of seed lots and their correlation with responses of seeds in open storage at MSU.

Crop/ AA Conditions	Germination % in Open Storage at MSU (mos.)									
	6	9	12	15	18	21	24	27	30	
Alfalfa										
40°C-100% R.H. - 120 hrs.	---- ^{1/}	.890 ^{2/}	.850	.880	----	----	----	----	----	
42°C-100% R.H. -84 hrs.	.635	.756	.755	.736	.597	.579	.541	.578	.495	
30°C-75% R.H. - 6 weeks	.659	.751	.692	.825	.641	.557	.612	.554	.469	
Bromegrass										
45°C-100% R.H. -72 hrs.	.795	.839	--	--	--	--	--	--	--	
30°C-75% R.H. -6 weeks	.978	.966	--	--	--	--	--	--	--	
Corn										
42°C-100% R.H. -84 hrs.	--	.722	.855	--	.827	--	--	--	--	
30°C-75% R.H. -24 weeks	--	.837	.835	--	.824	--	--	--	--	
Crimson Clover										
40°C-100% R.H. -72 hrs.	.851	.864	.961	.961	.953	--	--	--	--	
30°C-75% R.H. -9 weeks	.893	.900	.946	.956	.941	--	--	--	--	
Fescue										
42°C-100% R.H. -84 hrs.	.953	.968	.936	--	--	--	--	--	--	
30°C-75% R.H. -9 weeks	.976	.951	.902	--	--	--	--	--	--	
Garden Beans										
42°C-100% R.H. -72 hrs.	.537	--	.666	--	.701	--	.928	--	.867	
30°C-75% R.H. -16 weeks	.893	--	.909	--	.669	--	.538	--	.438	

Table 1 (continued)

Crop/ AA Regime	Germination % in Open Storage at MSU (mos.)								
	6	9	12	15	18	21	24	27	30
Lespedeza									
30°C-75% R.H. - 3 weeks	.856	.979	.876	--	.848	--	--	--	--
30°C-75% R.H. - 6 weeks	.841	.875	.940	.914	.977	--	--	--	--
Lettuce									
40°C-100% R.H. - 72 hrs.	--	.695	.716	--	--	--	--	--	--
30°C-75% R.H. - 15 weeks	.701	.849	.880	--	--	--	--	--	--
Onion ^{3/}									
40°C-100% R.H. -120 hrs.	--	--	.861	--	.877	--	.908	--	--
30°C-75% R.H. - 4 weeks	--	--	.931	--	.900	--	.882	--	--
Radish									
45°C-100% R.H. -48 hrs.	--	--	--	--	.914	.720	.954	.924	.953
30°C-75% R.H. - 24 weeks	--	--	--	.936	.917	.763	.957	.924	.944
Red Clover									
40°C-100% R.H. -72 hrs.	.895	.880	.918	.930	.948	--	--	--	--
30°C-75% R.H. -9 weeks	.940	.910	.919	.885	.938	--	--	--	--
Sorghum									
45°C-100% R.H. - 72 hrs.	--	--	.917	.928	.959	.921	.875	--	--
30°C-75% R.H. - 12 weeks	--	--	.939	.960	.967	.931	.912	--	--
Soybeans									
40°C-100% R.H. -42 hrs.	.826	.885	.717	--	--	--	--	--	--
30°C-75% R.H. - 9 weeks	.859	.736	.939	.811	--	--	--	--	--

Table 1 (continued)

Crop/ AA Regime	Germination % in Open Storage at MSU (mos.)								
	6	9	12	15	18	21	24	27	30
Timothy									
42°C-100% R.H. -72 hrs.	.677	.760	.614	--	--	--	--	--	--
30°C-75% R. H. - 6 weeks	.919	.910	.841	--	--	--	--	--	--
Watermelon									
45°C-100% R. H. -144 hrs.	--	--	.647	--	.858	--	.751	--	.731
30°C-75% R. H. 18 weeks	.539	--	.892	--	.925	--	.540	--	.641
Wheat									
45°C-100% R. H. -48 hrs.	--	--	.623	.703	.827	.923	.967	.953	.872
30°C-75% R.H. -12 weeks	--	--	.815	.853	.885	.925	.890	.915	.814

1/ --- Indicates data not available, not the lack of statistical significance.

2/ All coefficients of correlation are significant at the 1% level of probability.

3/ Periods of open storage for onions represent weeks instead of months.