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SEED DETERIORATION ^{1/}

James D. Helmer

Seeds are living entities which represent the basic source of existence for all life. Enclosed in these multi-configurated objects - seeds - are the essentials necessary for reproduction and consequently for your existence. However, seeds do not maintain forever the capability of reproduction (germination) for eventually the inevitable occurs.

Why do seeds die? The exact finite reasons are not known, but many of the factors which contribute to the deterioration of seed are recognized. Within the word death itself lie 5 basic causes of seed deterioration.

- D - Disease and insect infestations
- E - Environmental conditions prior to harvest
- A - Abuse (Mechanical damage)
- T - Temperature
- H - Humidity

Everything can be characterized, in some shape or manner, and seed deterioration is no exception. A few of these facets of deterioration are:

1. Seed deterioration cannot be prevented - it can only be reduced to a minimum.
2. Seed deterioration is an irreversible process.
3. Seed deterioration is at its lowest level at the time of seed maturation.
4. The rate of seed deterioration varies among different seed species.

^{1/} Reprinted from 1965 Proceedings, Mississippi Short Course for Seedsmen. Dr. Helmer was a member of the MSU staff in 1965.

A more detailed analyses of each of the five previously listed causes of seed deterioration and what can be done to minimize them should be of prime importance to seedsmen.

D - Disease and Insect Infestations: In some instances, this cause of deterioration is directly related to other causes of deterioration, such as temperature and humidity. However, seedsmen do have weapons against disease and insect infestation *per se* in seed. Just as the Yankees have used the two M's (Mantle and Maris) to combat other baseball foes, the seedsmen have the two F's (fungicides and fumigation) to combat deterioration of seed due to disease and insect attack.

E - Environmental Conditions Prior to Harvest: This poses possibly the greatest threat to quality seed production, for as of this date, no one has been able to devise an equation which can be used to control mother nature. In the Southeastern United States, the environmental conditions during the harvesting season are often other than conducive for quality seed production. Especially is this true in the case of plants which have an indeterminate fruiting habit, such as cotton. In this case, some seed (bolls) are exposed to the elements of nature for a considerable period of time prior to harvest. A good example of what can happen to cotton seed viability is shown in the following table.

Table 1. Germination percentages of cottonseed harvested from different positions on the plant after various periods of exposure.

Harvest Date (Weeks after boll opening)	Boll Position		
	Bottom	Middle	Top
1	77	81	78
3	54	56	84
6	22	55	84

As indicated by the above data, the longer the length of exposure before harvesting, the greater the degree of seed deterioration, except from bolls on the top portion of the plant. No decline in viability of seed from the top crop existed with an increased length of exposure before harvest because of the following reasons: First, the index of temperature plus humidity is higher near the bottom portion of the plant as compared to the top, and secondly, the environmental conditions existing during the boll opening period of the top crop in cotton are not as severe as during the boll opening period of the bottom crop.

Adverse environmental conditions, after maturation and before harvesting, can also affect the viability of seed from plants with a determinate fruiting habit. Excessive rainfall and freezing temperatures are probably the main demons.

A - Abuse or Mechanical Damage: During harvesting and processing, seeds are subjected to varying degrees of impaction and abrasion. Depending on the intensity of such impaction or abrasion, the moisture content of the seed, the thickness of the seed coat, and numerous other factors, a certain percentage of the seed will receive either an immediate lethal "punch" or a "blow" which will sufficiently weaken the seed so it becomes worthless for planting purposes after a few months storage.

Soybeans are particularly sensitive to mechanical damage. Their thin, fragile seedcoat offers little resistance to impaction forces during harvesting and processing. Seed moisture content is quite influential in determining this degree of damage. Recent research here at the Laboratory is presented in the following table which shows the influence of seed moisture content and height of drop onto a metal surface on the viability of Lee soybeans.

Just how severe a blow does a seed sustain after a free-fall of 40 feet: You can readily "feel" the answer by running into a brick wall traveling at a speed of about 50 feet per second.

Table 2. Laboratory germination and field emergence percentages of Lee soybeans after dropping seed on a metal impact surface at various seed moisture contents.

Moisture Content %	Test	Height of Drop (ft.)					
		0	5	10	10(2X)	10(4X)	20
8	Lab.	98	88	79	62	52	66
	Field	94	85	83	66	59	69
10	Lab.	98	91	84	74	62	72
	Field	95	92	83	74	64	74
12	Lab.	98	97	94	88	81	87
	Field	93	94	88	90	88	87
14	Lab.	98	97	97	96	98	95
	Field	96	92	94	94	92	97

I and H - Temperature and Humidity: Once seed are safely in the bag, the battle to minimize deterioration is about 50% over. Without a proper storage environment, good seed can become weakened in vigor and viability and medium quality seed can become worthless in a short period of time. Of the two factors, temperature and relative humidity, humidity is perhaps the more important but there is a definite interaction between the two as far as seed storage is concerned. The higher the percent relative humidity of the storage environment, the higher the moisture content of the seed (if not in a sealed container) which leads

to rapid deterioration of the seed.

In summary, I would like to say that the factors which have been enumerated on here today are not the only causes of seed deterioration; however, they probably represent the major causes of seed deterioration. Any one cause in particular can put a seedsman's balance close to the red ink stage and a combination of several can put you on the eligibility list for "foreign aid."